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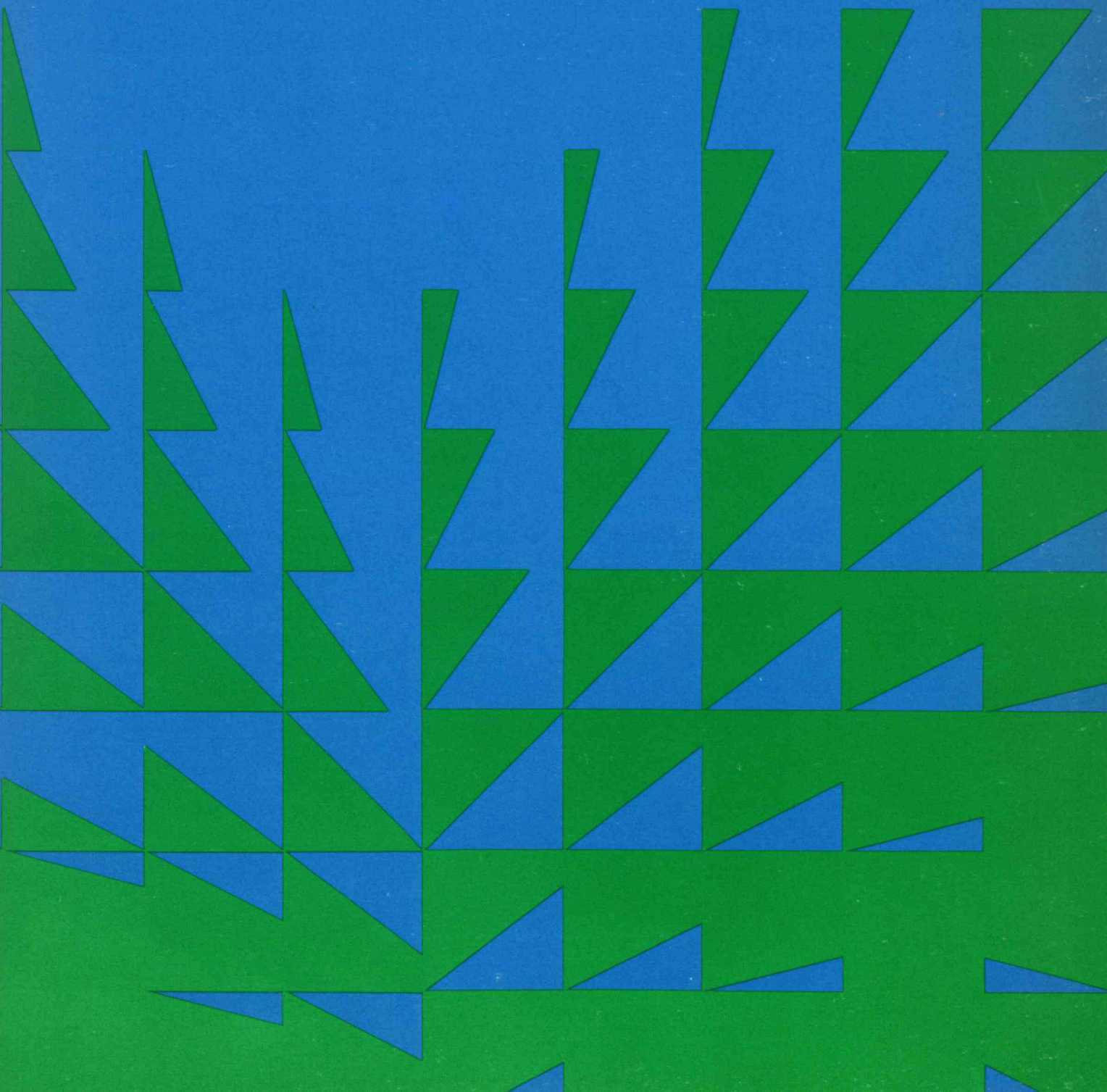
July/August, 1971. Price, $1.25

Cultivating the Beneficence of Science

Technology Review



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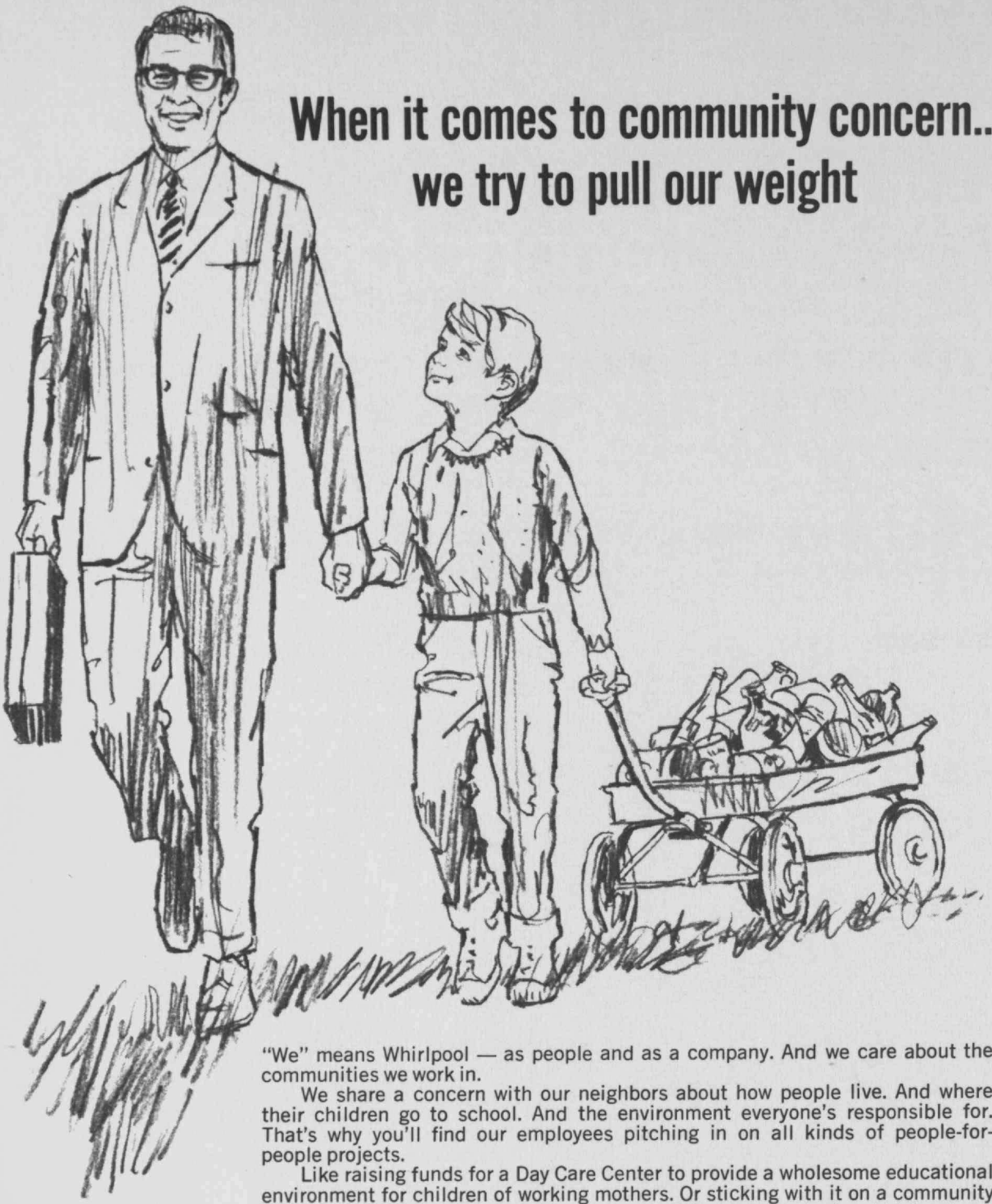

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The First Line

Few who attended M.I.T.'s 105th Graduation Exercises on June 4 will be surprised to find the Editor devoting this space to a portion of the Invocation delivered on that occasion by the Reverend John Crocker, Jr., Episcopal Chaplain at M.I.T. I am grateful for the privilege of doing so. —J.M.

O Lord God, Father of all men, what dare we Americans pray for this morning?

You have taught us that to pray for things without meaning it is blasphemy, to pray for things without intending to live and act to bring those things about is hypocrisy.

Your prophets in all ages have proclaimed that your judgments are true and righteous altogether, that those who sow the wind will reap the whirlwind.

What dare we pray for?

Dare we pray for peace in Southeast Asia? We claim to want peace yet the war goes on, in the name of gaining peace.

Dare we pray for an end to the arms race and the stabilization of nuclear power? We claim to want these things and yet are promised an increased military budget for next year, regardless of what happens in Viet Nam.

And, Lord, so many people's employment and professional security depend upon that budget.

Lord, make our prayers something better than blasphemy.

And dare we pray for freedom, equity and justice?

We claim to be committed to these values, yet we are a frightened, violent, and dangerous people. We refuse to invest more than a pittance of our resources to combat poverty, racism and the decay of our cities and our schools.

We repress rather than face our problems.

Lord, can profits mean more to us than peace and justice? Can tranquility, civil law and order without justice mean more to us than unrest and change in the name of justice?

We claim to mean what we teach our children, but when they hold us seriously to our teaching; when they point out our failures, our hypocrisy, and the contradictions in our policies, we find ourselves angered by their alienation and tempted to trivialize their idealism.

Lord, make our prayers something better than hypocrisy.

Volume 73

This issue completes Volume 73 of *Technology Review*. Indices to Volumes 72 73 will be prepared during the summer and available for distribution in the fall; indices to earlier volumes are now available at no cost from the Editors. The next issue of the *Review*, opening Volume 74, will be dated October/November, 1971, and is scheduled to appear late in September.

Readers may be interested to know that the *Review's* circulation will by then have grown to exceed 45,000. Many graduates of M.I.T.—some 32,000 as of now—receive the *Review* in consequence of the interest they express in their alma mater; and more than 13,000 other readers now enjoy this form of association with interests and issues which are central at one of the world's greatest technological institutions.

By most publishing standards these circulation figures are modest indeed; but that very characteristic also suggests that readers and Editors may share a closer relationship than is usually possible. We cherish that opportunity whenever it is presented.—J.M.

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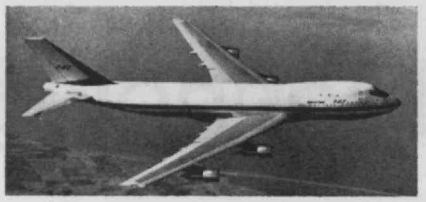

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Rates include Jet Air, Deluxe Hotels, Meals, Sightseeing, Transfers, Tips and Taxes. Individual brochures on each tour are available.

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Science Review
Robert C. Cowen

The Director of CERN has proposed a new research complex to be built and run almost indefinitely without significant yearly budget increases, except as necessitated by inflation. His plan will turn CERN into a flexible new research tool, promises physicists a glimpse of the 100,000-GeV world, and may yield "a new way of life for particle researchers."

High Energy at Low Cost

Some call it a bow to economy. Others consider it an imaginative new way to organize high-energy research. However you view it, the plan for building a new particle accelerator at CERN (Centre Européene pour la Recherche Nucleaire) promises to give Europe's famed high-energy physics center a renewed lease on life through the end of the century.

CERN plans to do more than just build another machine. The accelerator project will integrate all CERN facilities into a flexible new kind of tool that could open such vistas as particle physicists scarcely dream of today.

To begin with, the accelerator will be built to speed protons to energies of 150,000 million electron-volts—150 giga-electron-volts or 150 GeV in physicists' language. Later, by adding more magnet power, the maximum energy may be boosted to 800 GeV or a bit higher.

That would put the accelerator roughly in a class with the 500-GeV American machine now being tuned up at Batavia, Illinois.

However, the CERN design team under Englishman John B. Adams plans more ambitious operations. They hope to use the accelerator in conjunction with other CERN facilities to give experimenters at least a glimpse of the 30,000-GeV realm, and perhaps even of phenomena at 100,000 GeV. That puts the CERN scheme in a class by itself.

Add John Adams's promise that this new research complex can be built and run indefinitely without significant yearly rises in CERN's budget and you can see why CERN member countries finally gave the accelerator project the go-ahead earlier this year after many years of vacillation.

Dr. Adams has done more than design hardware. He has outlined a new way of life for particle researchers that enables them to meet today's twin needs for achieving ever higher particle energies while staying within stringent budgets. This is as much a contribution to high-energy research as any of the technical innovations that will go into the new machine.

Physicists vs. Politicians

The need for higher energies is inherent in this kind of research. Hitting atoms or molecules with fairly low energies excites behavior that reflects one underlying force. This is the electrical attraction and repulsion that governs chemistry.

Excite atoms with higher energies, and phenomena appear that reflect the action of nuclear forces. Go on raising the energies and a host of "basic" particles and their interactions appear (*see "Trend of Affairs," pp. 54-56*). While physicists see family relationships among them and regularities in their interactions, their role in matter's structure remains cloudy. May this perplexing interplay of particles reflect a still unrecognized truly basic force?

Physicists believe it will take far higher energies than they have used so far to discern any such underlying simplicity. They think they are far below the level where further increases in energy will fail to evoke distinctive new phenomena. It is this vision that leads them to seek ever more powerful and more costly particle accelerators.

Yet politicians who control national budgets tend to see this goal as a will-o-the-wisp. The physicists sometimes seem to them to be like spoiled children who tire of their toys and demand new playthings. And they feel that, even when the physicists make a sound case for an expensive new accelerator from the research viewpoint, national priorities today do not allow much new money to flow in that direction.

Designing for a Fund Plateau

Such was the box out of which the Adams team has led CERN. In the early 1960's, CERN physicists realized that their 28-GeV accelerator, then one of the most powerful in the world, was obsolescent. They proposed building a 300-GeV accelerator, probably at a new research site away from CERN's home near Geneva. This scheme was so expensive only six of CERN's 12 member nations wanted to support it. Even Britain, originally a supporter, dropped out in spite of a redesign that somewhat reduced costs.

When Dr. Adams took over the 300-GeV project in 1969 he had a twin incentive to rethink the entire scheme. For one thing, new technology had outmoded the old design. Equally important, he says, he realized that physicists had to learn to live on a plateau of level funding indefinitely.

Technically, progress in design of superconducting magnets made possible a new approach to getting high energies. The energy an accelerator can achieve, and the accelerator's cost, depend heavily upon magnet power. The more energetic the particles, the stronger the magnetic fields needed to confine them within an accelerator tube of given radius. Higher energies mean either bigger accelerators or stronger magnets.

Conventional magnets, with their high demand for power and cooling water, represent a sizeable capital investment for accelerator builders. Superconducting magnets should be able to generate very strong magnetic fields relatively cheaply. In such magnets, coil temperatures are kept within a few degrees of absolute zero. The coils lose electrical resistance. Relatively little power is needed to energize them. And they don't need massive cooling water feeds to carry away heat generated by electrical resistance. All told, they should make high energy accelerators cheaper to build.

While superconducting magnets aren't operational yet, they are coming along well enough for Dr. Adams to include them in his planning. This has produced the "missing magnet" design that is the planned accelerator's distinctive feature. It will be built with enough magnets to allow it to reach energies of 150 GeV. More magnets can be added later. And if they prove as feasible as Dr. Adams expects, superconducting magnets could be placed in the system to enable it to reach 800 GeV or even more.

This strategy has produced a machine design substantially cheaper than the old 300-GeV plan. It also has produced a machine of a size that can be fitted into CERN's Geneva facilities using land donated by France and Switzerland.

CERN, which straddles the French-Swiss border near Geneva, will soon get a 150-GeV proton accelerator—and the promise of a stable (except for inflation) research budget for the indefinite future. This photograph shows CERN's 28-GeV proton synchrotron in the lower right, with excavation underway for the 150-GeV machine nearby.

This resolved the question of where to put the new machine, an issue that had set CERN members squabbling. But more importantly, it enabled Dr. Adams to work out some rather large economies.

For one thing, the 28-GeV accelerator will be used to feed protons to the 150-GeV machine. That's a saving right there, since the machine would have required a comparable injector if built elsewhere. Also, CERN's experimental halls can be coupled to the new accelerator—again saving the cost of duplication at another site.

Then there are the intersecting storage rings which CERN has recently brought into operation. In these, beams of 25-GeV particles from the 28-GeV accelerator are stored. They circulate in opposite directions. For experiments, they can be made to collide, thus exciting phenomena otherwise obtainable only with a 1,500-GeV accelerator.

The rings aren't as versatile a tool as a regular accelerator. Experimenters are restricted to proton-proton interactions and related phenomena. They can't easily use targets of various materials. They can't readily lead off beams of high-energy particles for study outside the small volume of the beam intersection. But the rings do give them a viewport on a very high energy region, if not an open door through which to explore it.

Dr. Adams thinks that 125-GeV protons from the new accelerator could be fed into the rings if their magnet power were increased. When these intersected, they would excite phenomena typical of 30,000-GeV energies. If the accelerator were upgraded to provide 800-GeV protons and new storage rings were built to receive them, experimenters might get glimpses of the 100,000-GeV world.

Such developments would turn all of CERN into a kind of research tool physicists have never had before. Both old and new facilities would enable them to reach previously unattainable energy levels. And both old and new facilities would have the possibility of being upgraded in the future to a new level of usefulness.

This is the scheme that Dr. Adams thinks CERN could carry out on a funding plateau. Without building the new machine, CERN's budget probably would run to about 340 million Swiss francs yearly. With the new project, the budget will climb to 475 to 490 million over the next few years and then level off at 475 million. Except for adjustments to take account of inflation, he thinks CERN can live on that plateau and realise the ambitious research potential he has in mind.

Instead of thinking just in terms of a new laboratory and a new machine as their avenue to progress, Dr. Adams has led CERN researchers to think of getting the most out of all that CERN has. This is not just making do with old equipment alongside of the new. It is combining that equipment into a working whole that has a bright future in its own right. As he puts it, "With money running as it is, you couldn't do much better than a complex such as this to the end of this century."

Robert C. Cowen, Science Editor of the Christian Science Monitor, *studied meteorology at M.I.T. with the Class of 1949. He is now stationed in Washington, having recently been transferred from the* Monitor's *London office.*

"Science for the People," Ralph Nader, Charles Schwartz, John Gofman and Arthur Tamplin . . . all represent challenges to the traditional values of American technology. In responding to their challenge, it is well to remember that idealism has always been compromised by pragmatism, that their struggle is life itself.

Shaking Up The System

The following is a commencement address to an institute of technology:

There are great and radical forces of change today in American life. I believe they will also change American science and technology, and I think the change will be healthy. Even now, General Motors 1971 is not General Motors pre-Ralph Nader, or before our concern with the air that we breathe.

What we need—what we need from you who are new scientists and new engineers—is to make technology more human and apply it with reason. In the better phrase of one young organization, we need "science for the people."

This will not be easy, and may be impossible. In a historic sense, every great goal of man is impossible. Yet we gain and survive in the trying. It's like the saying in Washington, "If a thing is worth doing, it's worth doing badly."

It is one thing to put a stop for the moment to the development of an S.S.T. that is probably a technological danger and certainly a social frivolity. It is obviously another to do it on an international scale, so the decision may stick. It is one thing to put a stop to the S.S.T. and endless production of missiles, and another to turn a major share of our resources and our 50,000 unemployed scientists and engineers toward the development of mass transit, urban housing, and health centers—in short, to do the social and technological engineering to rebuild our rotted cities and growing slums.

Well, you say, why don't we divert some money to mass transit and housing? Ask the highway lobby. The oil and tire and auto and cement-rock-concrete-asphalt-road-construction people and all their political allies. This lobby, bulldozing non-taxpaying million-dollar-a-mile super-highways through formerly taxpaying swatches of city, is one of the most powerful forces in American state-house and Congressional politics. Any of you interested in the humane use of technology had better get into that political fight.

Anyone interested in the humane use of technology had also better ask: How can anyone but the rich afford to run for office without going into hock for campaign money—especially television money—to the lobbies. A few years ago one of Washington's brightest political writers, a nationally syndicated columnist, said, "Campaigning is getting so expensive that soon there will be only two possible sources of money, big business and the Mafia." We had better change this if we want to continue to have representative government.

There is a bill before Congress to limit the amount of money, and especially television money, candidates for national office may spend. The current Administration's thrust has been to weaken—not strengthen—it, because if you're in with big help, you want to stay in. This is one of the most important issues in this nation, and least appreciated.

The high cost of campaigning is one social price we are paying for one piece of technology: television. Scientists and engineers brought television into the world, but did not even argue that it be used not just for profit but also for education and for service.

Moving Mountains in Academe

What may help change this endless picture of mis-use and ill-use and non-use of technology is the action on the campuses. Five years ago, even now in some places, the action was mainly in the courtyards, on the lawns, in the streets, in the occupied presidents' offices. Today the radicals and the restless have moved on to the faculties, or co-opted them, in surprising number. Radicals have become a part of the warp and woof of many science faculties, not just rebels out on the lawn.

To these new academic rebels, the direction of American technology is still mainly technology for technology's sake, not for the people's. It is the production of missiles and H-bombs that threaten the race, and lesser weapons that annihilate Indochinese civilians. It is S.S.T.'s rather than decent cities. It is pollution.

It is "war crimes" for which President Nixon should be impeached—so it was charged before the American Physical Society in Washington this spring, not by some youth in jeans and red headband but by Dr. Pierre Noyes, a conservatively dressed theoretical physicist, staff member at Stanford's Linear Accelerator Laboratory.

Another new radical is Dr. Charles Schwartz, Professor of Physics at the University of California at Berkeley. A year ago he jolted his students by requiring them to swear a solemn oath to enhance life and never do harm, before he would teach them. This "Hippocratic oath for scientists" was his way, he explained, of struggling against what he called "the separation of science from life, which, if allowed to continue, will end only in death."

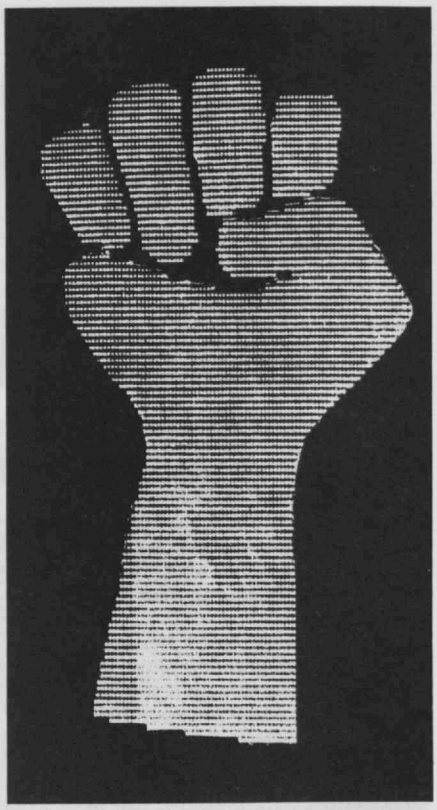
A few upset students rejected both his oath and his course. The Academic Freedom Committee of the Faculty Senate condemned the requirement. Chancellor Roger Heyns sent him a severe reprimand. This year, therefore, Professor Schwartz hasn't been requiring his oath, but he does discuss it with his students and urges them to take it if they want. And some do. And the Berkeley Physics Department now offers two new "experimental" courses on science and society.

Schwartz, Michael Goldhaber, Martin Perl and Marc Ross in January, 1969, organized "Science and Engineers for Social and Political Action/Science for the People." Its members are the most active, and—to us grayheads—often most aggravating, dissidents at many scientific meetings. Among several other such groups: the Science Action Coordinating Committee, Science in the Public Interest, Union of Concerned Scientists, Medical Committee for Human Rights, and many others.

With profound results. In the past five years, the young activists and the old, the angry screamers and the moderate speech-makers, the rock-throwers and the gentle have moved academic mountains.

M.I.T.'s famous Instrumentation Laboratory, home of secret guided missile and non-secret Apollo spacecraft guidance, is on the way to becoming the independent Draper Laboratories. Stanford had to

What shall engineers do with their technology? "Computer People for Peace" urges (and blasphemes about) humane uses for computers—and provides its members, for $1, with this computer-generated symbol of the radical revolution.



sever ties with its industry-oriented Stanford Research Institute. The University of California is renegotiating its Atomic Energy Commission contract to operate both the Lawrence Radiation Laboratory and the Los Alamos Scientific Laboratory. The University wants to make them less secret and more responsive to university and social goals. On almost every campus, there are new organizations and new thrusts, due to the new radical push.

One could tell the same story about the American Association for the Advancement of Science and the important National Academy of Sciences, adviser to the government.

Can "the System" Work?

But there are some troubling gaps between reformers and reformers. At its spring meeting, the long-stuffy Academy saw one of its few "young" members—Dr. Richard Lewontin, 42—resign in protest against its role as an adviser on classified military projects. This role—like the traditional role of M.I.T.'s "I" Lab—was defended by the Academy's anti-Vietnam leadership as "simply necessary, until all nations abandon weapons."

This raises the question: is some weapon-making indeed necessary, or is all simply criminal? The difference in point of view marks the gap between new and old science-activists. The harshness and intolerance of some radical views on the subject often shock an old humanist. Many deeply anti-war persons call it plain McCarthyism when they see a Dr. Edward Teller given S.E.S.P.A.'s "annual Dr. Strangelove Award," or a Berkeley anti-Teller leaflet with a map showing protestors the location of his home. ("Even the Joe McCarthyites at their worst," said columnist and liberal academician John P. Roche recently, "never mastered in this fashion the logistics of a psychological lynching. And given the fact that it takes only one twisted mind and a bomb," the pressure is "more than psychological.")

The older or milder change-makers, in an over-tired but useful phrase, want to "work within the system." To many of the angry new men, this is a dirty phrase. Dr. Schwartz, moral and courageous in his battle for a new Hippocratic oath, calls improving the system through better use of scientists and engineers "the technological crapout." Again, to quote from an article in the February issue of *Science for the People:* "The lines are clearly drawn. The polarization into those who unqualifiedly support this system and those who fight it at all levels progresses as more and more people become conscious of the inherent contradictions of capitalism."

The Public Interest in Science

Polarization is no solution, however, unless someone has a better system. Crying "technological crapout" ignores the fact that only with technology can we climb out of our pit. To me, the new fatalism will only breed new fatalities.

Happily, there seem to be developing some meeting points, some bridges between new radicals and the old. Dr. Martin Perl, 43, of Stanford's Linear Accelerator Laboratory, himself one of what he calls the "New Critics," says there is an "overlap," that: "The new critics have begun to study the structure of the scientific community and how it can best exercise its responsibilities . . . The new critics have added the crucial ingredients of political understanding, political responsibility and political action to problems formerly considered as mainly technological concerns."

Now he and I at least are on the same ground.

A young lawyer, who has been on the Washington scene only seven years, has taught us something else: that the American legal system plus public opinion, aroused, plus technology, make a powerful tool. He of course is Ralph Nader. He and the 25 or 30 other professionals around him—and much cheap and volunteer help—and other forces, too, have made Congress pass the Wholesome Meat Act of 1967, the Natural Gas and Pipeline Safety Act of 1968, the Radiation Control Act of 1968, the Coal Mine Health and Safety Act of 1969 and the Occupational Health and Safety Act of 1970. They have shaken and moved the Federal Trade Commission and Food and Drug Administration.

Nader is now calling on all scientists, engineers and other professionals to "blow the whistle" on their employers, whether corporations or government agencies, when they ignore or cheat the public. Many responsible journalists have long felt they owe their first loyalty not to their employers but to the public. So I naturally agree that engineers and scientists should practice a professional ethic which puts the public first.

Another method, not yet off the ground, is technology assessment, which someone has called "trying to avoid future shock." Drs. John Gofman and Arthur Tamplin, who have given the A.E.C. a bad time about radiation—and I think they have overstated their case—have made the beautiful suggestion that 10 Centers for Adversary Assessment of Technology be set up around the country, each staffed by 10 to 15 scientists and engineers, to contest new developments that they think threaten people.

Not to decide. That is the function of elected legislators. The point is to make sure there is informed debate, and—one would hope—debate early and worldwide, before other countries build their S.S.T.'s, for example.

Economist Milton Friedman has stated that no form of government can be devised "which will not be taken over by vested economic interests and exploited for the preservation and enhancement of their own wealth." The only course then is for us not to cop out but plunge in, with recognition that the system will never more than work, sort of.

I say: good for the radicals for shaking us up. None of us or our children will ever live in Utopia. The struggle is permanent, but the struggle is also life.

Victor Cohn is Science Editor of the Washington Post. *This essay—one of his regular contributions to* Technology Review*—is based on his commencement address to the University of Minnesota Institute of Technology in June, 1971.*

European Report
Stephen N. Salomon

Novosibirsk State University shares Akademgorodok, Siberia, with 17 institutes of the U.S.S.R. Academy of Sciences. It is the third-ranking scientific school in Russia, and life there does not always fulfill an American's preconceptions

A Year in Siberian Science

The strategic location, vastness, sparse population, and enormous resources of Siberia suggest that this region will play a significant role in the future of the U.S.S.R. The writer's experiences and observations while an exchange scientist at Novosibirsk State University in Akademgorodok, the gateway to Siberia, in 1969-70 indicate something of what the Soviets have in mind for this "land of banishment."

Novosibirsk State University was founded in Akademgorodok, the scientific center of the Siberian branch of the U.S.S.R. Academy of Sciences, in 1959. The main aim of the university is to train highly qualified specialists in mathematics, physics, chemistry, biology, geology, economics, linguistics, and history. The graduates fill positions in research institutes, industry, and schools throughout Siberia.

Akademgorodok is a college-like town of 40,000 people. It is located on the outskirts of Novosibirsk, an industrialized city with a population of over a million on the banks of the Ob River. Novosibirsk is the political center of Siberia, and it is the rail hub of the Trans-Siberian and Central Asian railroads.

The town of Akademgorodok itself has 17 research institutes, ranging from automation to thermophysics, and including a botanical garden and design bureaus. About 18,000 workers, 3,000 of them scientists, are engaged by the institutes. To date, funds of well over $200 million have gone into construction. Some of the well-known staff members working at the institutes and at N.S.U. are M. A. Lavrentev (hydrodynamics), G. I. Budker (nuclear physics), G. I. Marchuk (computer sciences), and A. P. Okladnikov (history, linguistics, and philosophy).

It is clear that Akademgorodok is a serious attempt on the part of the Soviets to form a well-integrated university-research-industrial complex. It has been indicated many times as an example of the decentralization of Soviet science into areas outside of European Russia. Despite its isolation, Akademgorodok is important enough to be put on the itineraries of famous visitors. In 1970, for example, Georges Pompidou and Neil Armstrong made inspection tours of this "Soviet model for future expansion in science and technology."

To learn more about N.S.U. I interviewed the Rector, Spartak Timofeevich Belyaev, a nuclear physicist who worked with Niels Bohr in Copenhagen and is now specializing on the many–body problem; he is especially dedicated to making N.S.U. one of the finest universities in the U.S.S.R. I also interviewed Tagei Ivanovich Zelanyak, Prorector, and I learned a good deal from many professors and students during both my nine months' stay in Akademgorodok and one month of traveling in the U.S.S.R.

No Discrimination, No Tenure

About 4,000 students are presently enrolled at N.S.U., and the University expects eventual expansion to reach 5,000. Dr. Belyaev emphasized the plan to maintain a smaller, more intimate university, compared to the "factories" of Moscow and Leningrad State Universities where the students come off "conveyor belts."

In the sciences, N.S.U. is considered by many to be the third-ranking Soviet university in quality. The teaching staff includes 33 Academicians and Corresponding Members of the Siberian Branch of the U.S.S.R. Academy of Sciences, 64 Doctors of Science and Professors, and 275 Docents (Associate Professors) and Candidates of Science (Ph.D.). A distinctive feature of this Soviet university is that almost the entire staff works part time in the various research institutes, thus keeping abreast of the latest developments in their fields. Approximately 500 diplomas are awarded per year.

The course of undergraduate study lasts five years, and of graduate study, three. Students generally enter at age 17 and finish graduate school at 25 or older. The entrance requirements include secondary school education and passing competitive entrance examinations, the difficulty of the examination being adjusted to yield the desired number of students. There seems to be considerable flexibility in admissions, for no one wants to eliminate good students. Those on the borderline are able to start N.S.U. with part-time evening study, later transferring to the day classes if their progress is good.

It is said that Orientals are favored and that there is no discrimination against women, but some professors try to avoid taking women graduate students because of the possibility that their research will be interrupted by pregnancy. As in the U.S., women tend to gravitate toward the biological sciences and humanities.

Students from throughout the Soviet Union aspire to attend Novosibirsk, partly because it is less competitive—ten applicants per place compared with 100 at Moscow University. But, though any student may apply at any institution, most Moscovites attend Moscow, Leningraders Leningrad, and so on.

In order to obtain good students, N.S.U. operates a preparatory physics-mathematics and chemistry-biology school, for which students are recruited throughout Siberia. This is a special N.S.U. activity made necessary by the weakness of Siberian schools. Good secondary schools exist in the European Soviet Union, and administrators of the well-known universities can pick the "cream of the crop."

First-year students at N.S.U. are distributed in the following manner: physics, 200; mathematics, 250; chemistry and biology, 150; geology, 50; history, 50; linguistics, 20; and economics, 75. The students take course work for two and one-half years and then begin to work in an institute on a small research project for a diploma. The last two and one-half years are mainly devoted to the project—but not to the neglect of courses. As a member of an English examining committee, I reviewed 11 students on their research work. Some typical project titles were "Mesic Atoms," "X-Ray Pictures by TV Methods," "Transmission of Genetic Information," and "Methods of Molecular Calculations."

Examinations take place twice a year,

The author (right) stands with his colleague, Yura Loburetz, in front of the Semiconductor Institute. Its mission, the advancement of field effect transistor technology, was decided by Moscow Academicians.
In late September, the Semiconductor Institute goes to harvest potatoes by hand for two days at a nearby state farm. In the center picture, the author (left), his colleague, Boris Bobylev (right), and a woman technician are preparing to dig in. The crowning of the King and Queen of N.S.U. is one of the most popular of many student festivals. Below, a contesting queen is being carried to the beach where the ceremony will take place.

and about 95 per cent of the students achieve passing grades. Each student has a grade book in which his professor marks the grade: excellent, good, or bad. Since the educational program is to a considerable extent centrally directed from Moscow, it is not surprising that the physics program, for example, resembles the program at Moscow State University.

There is modest communication among students, teachers, and administrators. This is accomplished by means of a monitor in each class who is selected by the students. His job is to keep roll (attendance is compulsory except for "excellent" students) and to go to the faculty chairman's office every week to consult with him. If the students complain that a professor is incompetent, the chairman can have him removed.

There is no tenure for professors. Their progress is reviewed every five years, but there is little chance of dismissal. I was told that one mathematics professor was replaced on account of poor performance. A frequent complaint is that some of the most outstanding Academicians come poorly prepared to lecture. Perhaps they are overburdened by too many responsibilities and thus have little time for preparation.

All students belong to the Trade Union of Higher Education, which assures the student summer vacations, medical benefits, and worker rights. In each class there are both a Union and a Komsomol (Young Communist) representative. The Komsomol representative organizes social work for the students, such as potato harvesting, and campus cleanup. Komsomol participation represents a step toward Party membership, but my impression is that most of the students were not interested in this activity. They were mainly concerned with the technical aspects of their work.

Sub-Subsistence Stipends

All students with good marks, more than 70 per cent, receive state scholarships for living expenses. There is no tuition. The rent for dormitory accommodations is about two rubles ($2) per month per person for a single, double, or triple room. One can probably eat for a ruble per day. The minimum stipend is 35 rubles ($35) per month. Fifth-course students get 45 rubles per month, and the best students in all classes (a committee decides who they are) receive 25 per cent higher stipends. These stipends may be compared with the 1968 Economics Institute estimate of the subsistence wage for Siberia—40 rubles per person per month. Thus despite government support at least 50 per cent of the students must obtain financial help from their parents. Some students, in order to obtain more money, work during the two-month summer vacation on construction jobs in the North, where they can earn up to 1,000 rubles. Others take summer jobs in the Novosibirsk area, but they earn much less.

Approximately 60 per cent of the students continued on to graduate school when the institutes were growing. Now, because they are fairly well staffed, only about 25 per cent of the students do graduate work. Others leave college after five years to teach at secondary schools or at higher educational institutions in Siberia and the Far East or work at various industrial research laboratories. Recruiters come to the campus during each spring semester to look for students, and some graduates wind up with more than one job possibility. If a student cannot find a job the state will find one for him, since each student is under a three-year obligation after graduation.

English Language for Space Buffs

The library facilities are extensive. In addition to a reading room containing 8,000 books, there is an N.S.U. library with 45,000 scientific and 5,000 non-scientific titles. In addition, all the institute libraries are available for research, and there is a 5.5-million-volume technical library which is reputed to be the second largest in the U.S.S.R. in a new nine-story building in Novosibirsk.

The principal American scientific journals are received about six months after issue, and this puts the Soviets at a considerable research disadvantage. *The New York Times, Newsweek,* and the like are received regularly but are not available to all readers. Among favorite periodicals and books of the students are: *Scientific American, Physics Today,* and *The Feynmann Lectures on Physics.*

Teaching laboratories are adequate, including experiments ranging from shock waves to lasers. But most laboratory experience is obtained in the institutes, where students are exposed to the latest in equipment and techniques that the Soviet Union can offer.

English language is heavily stressed at N.S.U., and it is a requirement for almost everyone; audio-visual techniques are used throughout the five years of training. During the third year, when research begins, a knowledge of English becomes an important learning tool. The Rector's desire is to create an English Department at N.S.U. in order to attract well-qualified faculty members, since education in English is usually suggestive of an effective education in other fields.

Stephen N. Salomon is a graduate student in the John F. Kennedy School of Government at Harvard, studying technology assessment. He graduated in physics from M.I.T. in 1961 and completed his doctorate in that field at Purdue just before going to Novosibirsk in September, 1969.

National Report
Victor K. McElheny

Insect-control substances less crude and dangerous than DDT are being developed. They are artificial hormones, similar to those used by the insects themselves—and by some plants, which have evolved their own anti-bug strategies.

Insects: Progress Toward Hormonal Control

Without much public attention, scientists are making substantial progress in developing a so-called "third generation" of insecticides based on the insects' own growth-regulating hormones.

In nature, these hormones help program the insects' development from eggs through larval and pupal stages toward winged sexual maturity. The hormones are a relatively simple, though central, component of the extraordinarily subtle system that the Earth's three million species of insects have for making adaptations to each other and to variations in sunlight, temperature and supplies of water and food. By such means insects survive triumphantly in numbers approaching a quintillion, in what is reputedly an age of mammals.

Insect hormones may provide an equally subtle and specific intervention into the insect kingdom by man, to replace the violent and indiscriminate methods now used, methods which already have backfired by producing new dangers to man—such as ominous buildups of D.D.T. in human fatty tissue, and the rapid natural selection of pesticide-resistant insects. As they are now envisaged, the hormone-like agents would not kill a wide range of species indiscriminately, as do the chlorinated hydrocarbons and other "second generation" insecticides. (These second generation chemicals succeeded such "first generation" agents as kerosene (for spreading on ponds), arsenicals and nicotine, with the force of an ecological hurricane, suddenly freeing hundreds of millions of people from the grip of malaria.)

Work on the hormone analogs, among other methods, is being pressed because nobody expects a single type of "third generation" control to work on all the 3,000 species of insects which carry human diseases or interfere with food supplies. Among the competing agents are chemical sterilants, sex attractants, releasing of radiation-sterilized males or colonizing with antagonist species of insects or bacteria (see *Technology Review*, June 1971, pp. 30-37).

Insects, at phases of their development when concentrations of a given hormone should be low, would encounter the hormone analog in high concentrations, in bait, at the edge of, say, a cotton field. The hope is that hormone agents would not have anything like the years-long persistence of some of the chlorinated hydrocarbons, but would last long enough, say a few weeks, to catch all the individuals feeding in one area. Scientists working on the problem, who are mostly in the orbits of the chemical firm Hoffman-LaRoche or of Zoecon, a subsidiary of the birth-control pill-maker Syntex, hope that insect species would find it hard to develop resistance to the non-toxic analogs of hormones controlling their own maturation.

The Story So Far

Progress on hormone insecticides in the past three years may be summarized as follows:

◇ A number of chemicals have been field tested against target species, such as the *Lygus* crop-bug in California, the *Dysdercus* cotton-staining bug in India, the cereal stink-bug in Bulgaria and, now, mosquitoes.

◇ The synthesis of the hormones themselves has been greatly simplified, most recently by a group under Harvard chemist Elias J. Corey and another in California which includes John B. Siddall, Zoecon's director of research. This helps to raise hopes of industrial-scale manufacture if this route to insect control proves practical.

◇ Earlier discoveries that substances very like the metamorphosis-promoting hormone called ecdysone and its opposite, the juvenile hormone, are synthesized in large quantities in trees and other plants—made by scientists like Carroll M. Williams of Harvard, Karel Slama of the Czechoslovak Academy of Sciences and Koji Nakanishi of Columbia University—have now been followed by Nakanishi's discovery of inhibitors of ecdysone in 20 different plants. This aspect of the "chemical warfare" between plants and insects raises further the hope of industrial manufacture.

◇ Polypeptide analogs of the so-called poly-isoprenoid juvenile hormone have been made and turn out to be active in very high concentrations against some bugs. This finding by Slama and others in Prague is part of a general investigation of the relation between the structure of hormone analogs and their affinity for various species, as well as how they act (which is still a puzzle).

◇ William Bowers of the U.S. Department of Agriculture's Beltsville, Md., experiment station has found that portions of "synergist" molecules which enhanced the effectiveness of the "second generation" pyrethrin and carbamate insecticides can be combined with portions of juvenile hormone molecules to make a new molecule with high potency for inhibiting maturation.

◇ Experiments in Prague by Slama and others with *Pyrrhocoris* linden-seed-eating bugs, whose males and females mate frequently with many partners, showed that an original application of 100 micrograms of juvenile hormone analog to a male could cause a kind of "venereal disease" preventing the hatching of a single egg laid by a large number of females. The linden bug is a relative of the Indian cotton-stainer.

Thus, much progress has been made in manufacturing hormone analogs in quantity, which is a necessity for the experiments on species-specifity and mode of action which must precede major commercial application. The finding that sufficient quantities of juvenile hormone to cause widespread sterility can be transmitted in sexual contact increases the prospect of a practical method of distribution.

Alternatives to D.D.T.

Consideration of alternatives to the chlorinated hydrocarbon insecticides is important at a time when there is a certain amount of hysteria about imposing an immediate worldwide ban on D.D.T. Many underdeveloped countries are likely to depend on D.D.T. for some years at least, reasoning that some further buildup of D.D.T. in fatty tissues is a moderate price to pay for continued control of malaria—itself an important component of any program to convince parents that their present children will survive and that therefore no more are

Our crude and gross anti-bug strategies, which now turn out to have damaged far more than their intended victims, may soon be replaced by a "third generation" of more subtle, specific, and lethal controls based on growth-regulating hormones of the insects themselves. (Photo: H. Armstrong Roberts)

needed. Poor nations cannot yield to the views of some environmental extremists in rich countries that the only issue of importance is a semi-religious conversion to ecological non-intervention. They can abandon D.D.T. only if something better appears.

Whether or not that happens depends upon whether there is adequate support for scientific research and for the attitudes which go with it. This principle operates for insecticides just as it does for developing less-polluting sources of power, or a less-polluting automobile, or a less-aggravating baggage-handling system at an airport, or varieties of grain that will multiply yields from the farms of Latin America and Asia.

In view of this, it is rather remarkable to find an agency like the National Science Foundation, which is justifying a large increase in its annual budget (from $500 million to over $600 million) with a new program of "research applied to national needs" (RANN), withdrawing its support from a scientist like Williams at Harvard. Fortunately, there are organizations like the Rockefeller Foundation, inventor of the graduate student fellowship and supporter for 25 years of the worldwide grain genetics program, which can step in to keep Williams' work going.

A Reasonable Accommodation With Life

For people concerned with mankind's practical needs, the issue is not "ecological non-intervention," but rather the development of gentler, more specific ways of managing that part of the environment which must be managed for man's benefit.

It is worth remembering, in a time when heightened environmental concern is affecting everything from the siting of electric power plants to the granting of foreign aid loans, that Rachel Carson's book, *Silent Spring,* published in 1962, was not the doom-crying conservationist tract it was made out to be at the time by a passel of frightened chemical manufacturers.

For one thing, the conclusions of the book—essentially a science writer's inspired popularization of the work of dozens of concerned scientists—were within six months confirmed by a special panel of the President's Science Advisory Committee (which was then headed by M.I.T. President Jerome B. Wiesner). The panel, headed by Prof. Colin MacLeod of New York University, recommended the U.S. government should become stricter and more comprehensive in its review of the safety of pesticides, should initiate a move away from persistent pesticides like D.D.T., and should change its philosophy of handling insects from total eradication to control.

At the end of their report, they acknowledged Miss Carson explicitly as the little lady who started the war: "Public literature and the experience of panel members indicate that, until the publication of *Silent Spring,* by Rachel Carson, people were generally unaware of the toxicity of pesticides."

With this judgment in mind, it is interesting to recall that the final chapter of the book was given over to the possible alternatives to general spraying with poisons—not to a cessation of intervention in the biosphere.

Miss Carson attacked the "practitioners of chemical control who have brought to their task no high-minded orientation, no humility before the vast forces with which they tamper." She said that the "control of nature" was "a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man." And so, she said, a "chemical barrage has been hurled against the fabric of life—a fabric on the one hand delicate and destructible, on the other hand miraculously tough and resilient, and capable of striking back in unexpected ways."

But the remedy for such short-sighted arrogance is not an abandonment of science or technology, in Miss Carson's view:

"Through all these new, imaginative and creative approaches to the problem of sharing our earth with other creatures, there runs a constant theme, the awareness that we are dealing with life—with living populations and all their pressures and counterpressures, their surges and recessions. Only by taking account of such life forces and by cautiously seeking to guide them into channels favorable to ourselves can we hope to achieve a reasonable accommodation between the insect hordes and ourselves."

It would appear that this philosophy has had its effect on those who are trying to develop hormonal controls on insect species. In a summary of recent work in the 1970 Zoecon annual report, Dr. Morton Grosser wrote: "It is wise to remember that powerful weapons demand great responsibility. Only one tenth of one per cent of the insects do us harm—and they were here first."

Invention-people and People-inventions

The Human Terms

The Employed Inventor in the United States
by Fredrik Neumeyer
M.I.T. Press, Cambridge, 1971
480 pp., $25.00

Reviewed by
Jacob Rabinow
Control Data Corporation

This reviewer, having been an employed inventor for the United States government for 16 years (at the National Bureau of Standards), having been the president of his own company for 10 years (Rabinow Engineering Co.), and having been employed in industry for the last seven years (Control Data Corporation), finds it difficult to suppress his own strong feelings about the employed inventor's role in society and review this book objectively and without emotion.

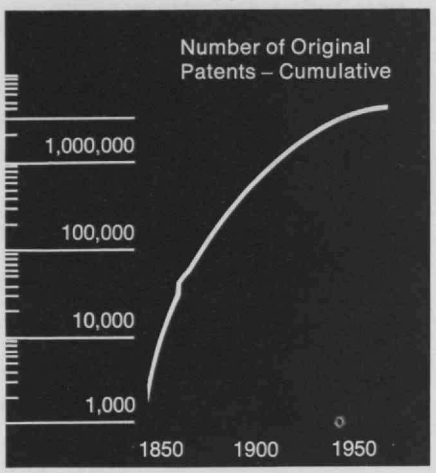
I found it an excellent factual compilation of the current situation. It gives a good overview of the practices and policies of government, industry, and universities as they apply to their employed inventors and gives many carefully documented examples of how theory and practice of the laws and customs actually work. There is a particularly good summary of the legal aspects of the employer-employee relationship by John Stedman.

For those of us who are interested in some of the human factors involved in the way the employed inventor operates and how he relates to society, I found the book lacking. Here and there there is a hint or statement that relates to this, but these, in my opinion, are much too brief. Perhaps the discussion of the environment that makes the employed inventor invent and how this environment differs from that of the so-called independent inventor may not belong in this book, but I think one cannot separate these factors from the cold statistical analysis.

Unanswered Questions
Many questions were not even touched on. I found, for example, no discussion of the relationship between the dollars spent on government-sponsored research and development and the number of inventions that result. Why, for example, does industry get 100 times as many inventions per dollar from its own research and development as it does from work for the government? How about inventions per dollar of industry versus the university, or the large versus the small corporation? There is one sentence in the book that hints that, perhaps, industry reserves its best inventors to work on its own problems, but is this the whole story? Another question: Why, in spite of the tremendous increase in research and development money over the last few decades, is the number of patent applications per year filed in the U.S. Patent Office static?

Question: How about comparing the number of patents per person filed in the United States versus that of other industrial countries? Question: Do patents increase or decrease the competition in particular business fields? Question: How do large corporations see the patent system and how do small corporations see it? Is it true that patents are nothing but a nuisance to large corporations since they can get along beautifully without them? Is it true that some small companies could not get started at all without patents? I disagree violently with at least one statement in the book that implies that patents are hinderances to competition.

Values and Ethics
I would have liked to see more value judgments about employer-employed inventor relationship. For instance, I bristle when I read that some companies demand that an inventor cannot work for any competing company for a year or two after he leaves a particular employer. Since an employee has to make a living in the field in which he is expert, this essentially means that he has to change industries when he can no longer tolerate his present employment. I think this practice should be outlawed. I also object to any "hang-over" contract that one cannot apply for a patent in a field in which one is employed for a year or two after leaving a particular employer. I think there are enough legal recourses to protect the employer from theft of inventions without such "yellow-dog" provisions.



Relative to the rapid post-war growth of R and D spending, the number of patents issued in recent years has remained fairly static.

I do not believe that special rewards should be paid to an employed inventor by his employer when the invention is part of his job. I believe that salaries usually do, in fact, reflect the value of an employee, and inventiveness is only one of these values. I would have liked to see a study in the book of the comparisons of salaries of employed inventors as related to salaries of those who do not invent. I would have liked to see this study made on a broad spectrum of inventors both in government, universities, and industry. This could, or perhaps would, lay to rest the fiction that employed inventors do not get paid for their inventions.

I was also surprised that no comment was made as to the fairness of the practice, particularly of universities, of transferring their patent rights to special organizations like the Research Corporation. I am somewhat dubious of the fairness of the paying to the employee something like 15 per cent of the royalties collected. Since the normal royalties may be of the order of 1 to 3 per cent of the value of the product, 15 per cent to the inventor is a very small part and for most inventions would probably be

a negligible amount. Perhaps in a few rare cases the inventor does receive substantial sums under such an arrangement, but in the case of the vast majority of inventions, the percentage collected by the agent seems to me to be too high.

In sum, while as a factual compilation it is excellent, as an analysis of the overall social aspects of the position and operation of the employed inventor I think the book leaves something to be desired. Again, I do not know whether this was the deliberate intention of the author. Perhaps other books cover the subject from this point of view, but I found that for me, at least, these deficiencies were important.

Instant Symposia

Biomedical Engineering Systems
Manfred Clynes and J. H. Milsum, editors,
McGraw-Hill, New York, 1970
653 pp., $27.50

Reviewed by
Philip A. Drinker
Lecturer, Department of Mechanical Engineering, M.I.T.

Biomedical Engineering Systems is a collection of 15 papers by 20 contributors. The topics are organized in "a logical (sic) sequence of four main groups: Instrumentation, Control of Information and Energy, Analysis, and Artificial Devices."

Having made this organizational decision, and after inviting manuscripts from the contributing authors, the editors apparently felt their job was complete. It was not. The quality of the papers is uneven and their scope is impossibly broad; minimal editorial attention was given to the figures (many are captioned with a single abbreviated phrase, followed by a reference); and there are frequent minor, but annoying, mistakes or misstatements.

That a large group of authors should vary in their own research interests and in their predictions of the course of future developments is natural, and could provide a strong basis for a broad perspective. However, the editors made no effort to examine, reconcile, or evaluate these differences—in other words, to exercise editorial discipline.

Keeping Up
Any text is certain to be out of date as soon as it goes to the publisher. This is a fact we all live with, both as readers and as authors. There are several ways to deal with the problem. The first is to reduce the turn-around time as much as possible. Many of the papers have references stopping at 1966 or 1967. For a book published in 1970, this shows inexcusibly slow publication procedures. Far more important than the time-table, however, is the way in which an author deals with the inevitable passage of time and the intervening developments, some of which will render his own views obsolete.

Dr. Clynes' own chapter "Toward a View of Man" deals with a tantalizing and extremely challenging concept—that of quantifying various aspects of human behavior and response or performance. How is it that a musician such as Toscanini could conduct three different performances of the same piece of music, over a span of more than 20 years, with nearly total reproducibility? What constitutes the grace imparted to a passage by Pablo Casals as opposed to the rendition by a promising student who played the same section flawlessly? Clynes' work shows great imagination and challenge, and the interested reader may wish to collect and study his bibliography. However, when he outlines experiments to measure human responses to various, highly specialized stimuli—emotions, the music of different composers, and the performances of that music by different musicians—he provides wholly inadequate scientific basis for the experiments and the conditions under which they were performed. Therefore, the chapter itself does not give credence to his ideas, some of which may indeed ultimately prove to be worth pursuing.

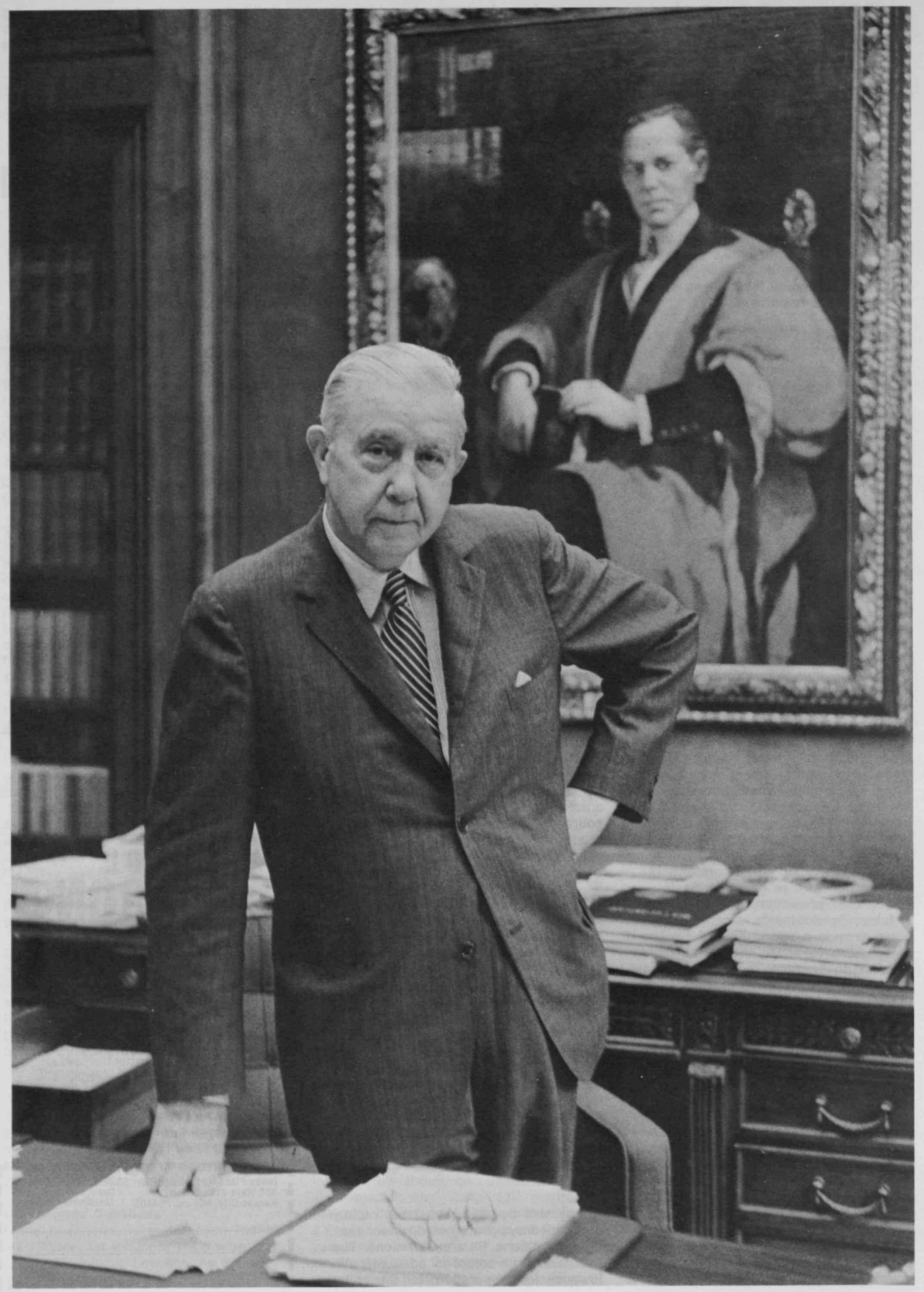
Two of the papers were refreshing in this otherwise disappointing collection. Professor L. R. Young's chapter on recording eye position and Wilson Greatbatch's review of physiological stimulators for clinical use are extremely interesting to read, they include extensive bibliographies up through 1969 (this does represent a reasonable time lapse), and, more important, they indicate the trends of research and development rather than being limited and dogmatic over the current state of the art. Greatbatch's chapter especially shows thoughtful planning and presentation, with consideration given to related topics such as implantation materials and power sources. As mentioned previously, the reader may find his review of power sources more useful than the chapter on the same subject.

A Useful Niche?
In a rapidly evolving field such as bioengineering, which is of central interest to a growing number of graduate students and faculty and which will undoubtedly represent an increasing portion of the nation's industrial effort, good reference texts are certainly needed. I submit, however, that this need can never be met by these multi-authored, instant symposia. In passing, it is worth noting that such collections are becoming fashionable in all technical fields, and bioengineering is not alone in promulgating the trend. To be sure there are multi-authored texts, such as the *Handbook of Physiology*, which stand as major reference works in their fields.

It may well be that occasional rapidly assembled symposia could, under the right conditions, fill a useful niche. The essential requirement is adequate allowance for preparation: for the editors possibly three months full time; for the authors a month should suffice. The editors should have the time and determination to maintain vigorous discipline: to keep after recalcitrant authors, and to insist that each author read, assimilate, and criticize every other chapter in the book. This latter tactic would also tend to keep the scope manageable.

The editors of *Biomedical Engineering Systems* have followed a format set by other works, possibly at the instigation of overenthusiastic publishers, which results in an impressive appearing volume of no lasting value. This publication trend merits careful reconsideration.

Acknowledgement
The reader will recognize that *Biomedical Engineering Systems* encompasses far too broad a scope for a single reviewer to treat knowledgeably, and in depth. (Did the editors find themselves in the same trap?) I gratefully acknowledge the comments of Professor William M. Siebert of M.I.T., Dr. Michael L. McCartney of the University of Virginia, John L. Lehr of Carnegie-Mellon University, and Mr. John R. Tole, of M.I.T. and the Peter Bent Brigham Hospital. This reviewer's own competence is primarily in the design of artificial organs and areas of physiology related thereto, with a reading knowledge in some of the neighboring fields such as prosthetics, implantible power sources, and biomaterials. After reading the chapters in these areas, with the growing conviction of the tone this review would take, it seemed absolutely essential to obtain comments on the other fields in order to make the review both fair and defensible.



For nearly 50 years James Rhyne Killian, Jr. (*opposite*), has devoted his extraordinary talents—a facile pen, abundant ability as manager, and great energy and understanding—almost singly to the purposes of the Massachusetts Institute of Technology and to those national issues which center around them

George R. Harrison
Dean of the School of Science, Emeritus

The Killian Years and M.I.T.

One fortunate enough to have been a part of M.I.T. for the past 40 or more years has observed a rare, and probably unique, phenomenon—the rise, development, and sevenfold efflorescence of one of its sons through positions of increasingly important leadership, until he became the very backbone of the institution. Who other than James R. Killian, Jr., has served his university so ably in so many capacities? Student, editor, alumni officer, Executive Assistant to the President, Executive Vice President, Vice President and Secretary of the Executive Committee, President, and finally Chairman of the Corporation, to say nothing of Science Advisor to the President of the United States—the list itself is eloquent.

The life of a college president is hard, not only in ways which are all too apparent, but in others familiar only to persons who have passed through the experience, or who have worked closely with presidents in their daily rounds. With a five-fold constituency of students, faculty, staff, alumni, and potential benefactors, the university leader must quickly become a perceptive equilibrist. This requirement Jim Killian has fulfilled *par excellence*.

Only a few remain who can remember the arrival from North Adams, Mass., in the fall of 1923, of young Rhyne Killian as a sophomore at the Institute. Born in Blacksburg, South Carolina, on July 24, 1904, he became more closely identified in the minds of his friends with North Carolina, where he had attended the college which was later to become Duke University. At M.I.T. he majored in Engineering Administration, where was broadened and deepened the foundation—surely already laid genetically—of his flair for management.

In 1925 young Killian became acquainted with a freshman newly arrived at Wellesley from North Carolina. She was Annie Elizabeth Parks, now celebrated as "Liz Killian." They were married in 1929, shortly after her graduation and three years after his. A daughter, Carolyn Makepeace, and a son, Rhyne Meredith, came along during the next few years, and Jim and Liz Killian are now proudly responsible for the existence of six grandchildren.

Although managing ability and human understanding are Dr. Killian's greatest assets, his career has been forwarded by his love of the written word and his skill in the use of the English sentence, which, as Winston Churchill wrote, is a noble thing. Young Rhyne showed an early flair for writing and editing, and in his junior year he was elected to the Editorial Board of *The Tech*. As a senior he became its Editor. Soon after graduation in 1926 he was chosen by Harold E. Lobdell to be Assistant Managing Editor of *Technology Review*, and he was made its Managing Editor in 1927 and Editor in 1930. He was to hold the editorial chair for nine years. During this period he also became Treasurer of the Alumni Association and increasingly identified with alumni affairs.

His literary flair, evident in the polished prose of his nearly 250 essays, speeches, and commentaries, stood Dr. Killian in good stead, especially when he was elected President of the Institute. For it enabled him to attack skillfully the syntactical load that must be borne by a leader of scholars, and to dispatch it with relish.

One of his first jobs after becoming Editor of the *Review* was to write an appreciation of M.I.T.'s new President, Karl Taylor Compton, the professor of physics from Princeton who had been selected to lead M.I.T. in 1930.

In 1932 Dr. Compton structured the Institute into three schools, and Deans of Architecture, Engineering, and Science were appointed. Vannevar Bush, Dean of Engineering, was made also Vice President of the Institute. When Dr. Bush left in 1938 for the presidency of the Carnegie Institution of Washington, Dr. Killian was called from his Editor's chair to become Executive Assistant to President Compton. He had been connected with the *Review* for 13 years, and had helped to put out 115 monthly issues. He initiated the copyrighting of its contents and produced a cumulative index covering its first three decades. As a national newspaper was to note later, "As Editor he aided in making the *Review* one of the world's most respected technical publications."

Freedom from Bureaucracy

In the President's Office it soon became apparent that Jim Killian had many virtues to bring to his new work besides a facile pen; he was closely familiar with alumni affairs, he knew how to set up a budget and follow it with flexibility, and—especially—he was entirely free of the bureaucratic mannerisms so prevalent among youthful assistants who find themselves in a position to

The illustrations accompanying this appreciation of James R. Killian, Jr., '26, from the files of *Technology Review* form an informal chronicle of Dr. Killian's years at the Institute:

1936—The Editor of *Technology Review* (extreme left) takes the stance of a good reporter, listening to the Alumni Day conversation of members of the Class of 1916.

1946—Greeting James S. Craig (left) and Herbert J. Hansell on Class Day.

1949—With principals at the dedication of the 12-million-volt electrostatic generator: left to right—George R. Harrison, the author of the accompanying article; Jerrold R. Zacharias, Director of the Laboratory for Nuclear Science; Captain John G. Johns of the Office of Naval Research; Dr. Killian; and Karl T. Compton, Chairman of the Corporation.

make decisions in the absence of their principal.

My pile of pages copied from *Technology Review* concerning the activities of James R. Killian, Jr., compiled by a devoted associate editor, a lady who worked in the *Review* office during much of his period at the Institute, stands nearly a foot high. It tells me, for instance, that the year 1940, with Jim ensconced at his executive desk in the President's office, was marked by the publication of his book entitled *Flash!*, co-authored with Professor Harold E. Edgerton, which dealt with the new methods of stroboscopy and flash photography developed by the latter. A second note indicates that J. R. K., Jr., was appointed Chairman of Alumni Day in April of that year.

Friendly but Firm

By this time Dr. Compton's presence was beginning to be required in Washington and elsewhere an increasing portion of the time, and Dr. Killian found himself needing to make spot decisions to keep the Institute on an even keel in the absence of his chief. The National Defense Research Committee had been set up through the initiative of Vannevar Bush, and Dr. Compton and President Conant of Harvard were Bush's two closest cooperators. Jim Killian was the one to stay at the Institute and mind the store. He demonstrated an instinctive ability to handle people and to offset the occasional budgetary derailments which resulted from the importunities to his chief of temperamental professors. Dr. Compton combined such sympathy with empathy that he probably never said No to any semi-reasonable request in his life; Killian quickly achieved a reputation for being accommodating and friendly but firm.

By 1943 Dr. Compton and a large part of the Institute faculty and staff were engaged almost full time in war work, and large numbers of scientists and engineers from other institutions were arriving on the M.I.T. campus to join the Radiation Laboratory and other defense activities. On July 1 of that year Dr. Killian was promoted to Executive Vice President. The inclusion of the term Executive in his title was explained at the time to intimates by Dr. Compton as recognition of the fact that Jim was not in line for the presidency of the Institute, which should be filled by a scientist or an engineer. Compton, whose admiration for his able assistant was unbounded, issued a statement in which he said, "The war has multiplied the Institute's activities several fold and has complicated it at all operating levels. Mr. Killian has shown fine executive capacity, knows the Institute's internal affairs and its alumni organization, and has the confidence of all with whom he associates to an extraordinary degree."

So it was that James R. Killian, Jr., as Executive Vice-president (and in those days there were no others, executive or otherwise) ran the Institute, with support from a chief who was necessarily concerned with administration of national affairs. Killian inevitably took a heavy share of responsibility for war-related activities at the Institute. In May, 1944, he wrote for the *Review* an article entitled "The Little Red Schoolhouse," pointing out that while the M.I.T. Division of Industrial Cooperation had in 1940 36 active contracts which in-

1949—Appointing Winston Churchill an Honorary Lecturer at M.I.T. (Mr. Churchill had come to participate in M.I.T.'s Mid-Century Convocation, which culminated in Dr. Killian's inauguration as President of the Institute.)


BURTON

volved an expenditure of $100,000 per year, the 1944 program had 189 contracts which ran to $25,000,000. There had been a five-fold increase in staff in three years, and total Institute expenditures had risen from $4 to $30 million, while the peak student enrollment was 50 per cent above normal.

By January, 1945, it was evident to certain members of the Corporation that Jim Killian had much more to offer the Institute than had yet been appreciated. Dr. Compton had been President for 15 years and would before long be retiring; furthermore, the Institute was getting so large that it needed two leaders. Compton and Killian had worked exceptionally well as a team, with one serving principally as "outside" and the other as "inside" man. Furthermore, other universities were looking for presidents, and M.I.T. did not want to lose Jim Killian. It was high time to get rid of that "executive" modifier, with its artificial connotation. So the Corporation announced, through Dr. Compton, that the Executive Vice President had now been elected to the *advanced* post of Vice President of the Institute and Secretary of the Executive Committee of the Corporation. Jim's formal introduction into the privy councils of the Institute's governing body was an obvious grooming for the presidency. (Some competition for this post still existed, however, particularly from scientists who had risen to prominence through their successful administration of large defense laboratories.)

It has often been pointed out that there is a tendency among university trustees to select a president alternately from some field of scholarship, and from the field of management. Only occasionally can a man who is willing to subordinate his personal life to the demands of the presidency be found who is skilled in both fields. When, as happens still more rarely, that man is a born educational leader, the institution is fortunate indeed.

In June, 1945, Dr. Killian came into being, by way of an honorary degree from Middlebury College. Even the 37 other honorary degrees which have followed would not have sufficed to offset the lack of an earned graduate degree in the minds of most college trustees seeking a president, were it not for the fact that in this case their possessor was so obviously the cultural equal of his faculty.

Celebrating the Uncommon Man

So it came to pass that in November, 1948, James R. Killian Jr. was elected "President-Designate" of M.I.T. Although Dr. Compton, now in his 18th year as M.I.T.'s President, had been called to an important post in Washington to succeed Vannevar Bush as Chairman of the Research and Development Board of the National Military Establishment, he would continue to be available as Chairman of the M.I.T. Corporation. His announcement said, "Ever since the beginning of the war, Dr. Killian has carried a major portion of the duties of the President's Office with such constructive imagination, good judgment, and administrative skill as to have won the full confidence of the Corporation, staff and student body, and alumni."

A faculty member who spoke informally at the time

1949—Receiving the Honarable Pandit Jawaharlal Nehru, Prime Minister of India, and Mrs. Nehru.

1951—With the Honorable Harold H. Burton and Mrs. Burton at the dedication of Burton House in honor of Justice Burton's father.

1952—*Receiving the Freedoms Foundation Award from Harold* C. Case, President of Boston University.

1954—Presenting a gift to the late Walter Humphreys ('97) for 25 years as Secretary of the M.I.T. Corporation.

1951—With the late Alfred P. Sloan, Jr. ('95), at the "Victory Dinner" of the Committee on Financing Development in New York.

1955—With T. Keith Glennan and Richard S. Morse, '33, at the Alumni Day luncheon.

1952—A moment of bemusement following the dedication of a shell in his honor.

1952—Opening the Coop's new bookstore.

Speaking to members of the M.I.T. Corporation this spring, Dr. Killian expressed to them "our deepest and most grateful thanks" for himself and for Mrs. Killian, the former Annie Elizabeth Parks—who was a Wellesley co-ed when Dr. Killian won her in 1929. "We have lived and worked here as a team, and I could not have stayed the course alone," he told the Corporation.

about Killian said, "There are two amazing things about Jim as President of M.I.T. First, he is going into the job with his eyes open. Often catching a President is difficult. You may have to go off a long way and find someone who doesn't know the institution well. Then you spring him on the faculty, which is usually willing to give a stranger the benefit of the doubt for at least a week. Then you promise the candidate all the money in the world to spend, without telling him that he has to raise it himself. . . . In Jim we have the double phenomenon of a President who knows in advance what he is up against, and who has had the faculty wholeheartedly behind him for many years."

On April 2, 1949, James R. Killian, Jr., was inaugurated as tenth President of the institution, amid ceremonies whose splendor was enhanced by the fact that they marked the culmination of a three-day Mid-Century Convocation on the Social Implications of Scientific Progress. Winston Churchill spoke at two assemblies held in the Boston Garden, on both occasions to overflow audiences exceeding 15,000. The young President-to-be presented an honorary lectureship to Mr. Churchill, who responded that he now could come and lecture the M.I.T. at any time he desired.

Growing Into the Job

The next ten years formed a period of brilliant advancement for the Institute, and they were full ones for the Killians. The new President rapidly grew into and around his job. He developed that indispensable attribute of a leader called "presence." Following a president who possessed this quality in abundance, Jim might have expected to have his work cut out, but there was no noticeable dip at M.I.T.

At first Jim Killian was a good but not an outstanding speaker. He was simple and direct and lacked objectionable mannerisms, but his verbal utterances often lacked the polish of his literary efforts. This would not be worth mentioning had he not over the years developed such outstanding ability to think on his feet, to express succinctly the essence of a point he was making, and to keep an audience entranced with his train of thought. Today few can match his polished assurance, as when serving as moderator of a symposium.

The post-war years were marked by great expansion in M.I.T., carried along by a gigantic wave as the nation integrated much of its war-born progress in technology. A returning student body had to be taken care of. Many veterans were motivated toward education as few have been motivated in recent years. Outstanding men who had risen to eminence in the wartime laboratories were attracted to permanent Institute faculty positions. Decisions had to be made as to which types of research should be continued and which dropped. Overexpansion under the temptation of increased government support of research had to be guarded against.

In 1957 Killian was called to Washington as Special Assistant to the President for Science and Technology, which led to his becoming Chairman of President Eisenhower's Science Advisory Committee. Later he was also to become a member of the President's Ad-

1955—Dr. and Mrs. Killian greet members of the graduating class in the receiving line following the Commencement Luncheon in the Great Court.

1961—Dr. Killian receives a clock that runs backwards from the Class of 1911 on the occasion of its 50th reunion; they hoped, they said, it promised eternal youth to their favorite M.I.T. man.

1971—A standing ovation by M.I.T. alumni finds Dr. Killian alone—and for one moment speechless—on the Kresge Auditorium stage on June 7. He leaves full-time duties at M.I.T., he said moments later, with confidence in the Institute. Having visited more than 5,000 alumni and their families across the U.S. and Mexico in the spring, said Dr. Killian, he is certain that M.I.T.'s graduates are in fact accomplishing the Institute's and their purpose of augmenting the quality of life in the U.S. through science and engineering. As he said in his inaugural address as President of M.I.T. 22 years earlier, said Dr. Killian, technology remains "essential to the health, prosperity, and security of our country."

visory Committee on Management, of his Board of Consultants on Foreign Intelligence Activities, and of many other *ad hoc* governmental bodies.

In 1959 Dr. Killian, now largely preoccupied with these broad responsibilities, became Chairman of the Corporation, and Julius A. Stratton became President of M.I.T. Seven years later, when Stratton retired to become Chairman of the Board of the Ford Foundation, Killian presided over the induction of Howard W. Johnson as President, and five years later still, over the selection of Jerome B. Wiesner. He will have had the unusual experience of installing three of his successors.

"In, of, and for the Institute"

A mere listing of the honors and awards which have come to Dr. Killian, together with his membership on the boards of directors of important corporations and his other activities on the national, state, city, and Institute levels would more than fill this issue of the *Review*. To indicate the catholicity of his interests and the breadth of his activity, we need only list a few of his writings and speeches of the past year.

Science and the State Department: A Practical Imperative
The Struggle to Stay on Top
Lift the Human Spirit!
Enhancing the Role of Women in Science, Engineering, and the Social Sciences
Teaching is Better than Ever
The Engineer in the Public Arena
In Dreams Begin Responsibilities
The Past Shares the Present
Youth Wants to Know
The Distant Sounds of Christmas
The Scientist as Humanist
University Research and National Priorities

Frederick G. Fassett, Jr., whose association with M.I.T. spans most of Dr. Killian's, first as a teacher of English and humanities, then as Killian's successor as Editor of the *Review*, and most recently as Dean of Residence, has wisely summarized the essential character of Killian's contribution: "No other man has equaled his dedication to the Massachusetts Institute of Technology. For the best part of half a century he has been in, of, and for the Institute and all it stands for."

George R. Harrison came to M.I.T. to be Professor of Physics just seven years after J. Rhyne Killian arrived as an undergraduate, and he became Dean of the School of Science just two years after Dr. Killian joined the Institute's administration as Executive Assistant to President Karl T. Compton. Dr. Harrison has thus been a close associate and keen observer of the Killian career for more than 40 years. Now Dean Emeritus, Dr. Harrison a distinguished spectroscopist whose contributions to science have been equally great in office as in laboratory. He is also the author of well known books about science for laymen—*Atoms in Action* and *What Man May Be.*

An editorial note about this special issue of Technology Review *dedicated to James Rhyne Killian, Jr.*

A "Major Force" for Science and for M.I.T.

This issue of Technology Review *is dedicated to James Rhyne Killian, Jr., whose leadership of the Massachusetts Institute of Technology—and of the nation in those fields to which M.I.T.'s principal efforts are devoted—will stand every judgment which history can render. The three principal essays commissioned by* Technology Review *are seen by the Editors to complement the thrust of Dr. Killian's own contributions—the place of science in a democratic society, the opportunity for creativity which scientific curiosity gives to mankind, and the beneficent uses—as typified by public television—of science for the public good.*

During the spring, as Dr. Killian's plans to retire after nearly 50 years of active membership in the Institute community—for 12 years with Technology Review, *10 years in the President's Office, nine years as President, and 12 years as Chairman of the Corporation—became more widely known, the accolade of praise became a torrent to which this Editor can hardly hope to add. He chooses, instead, to select from the words of others in the hope of conveying to readers some sense of the warmth and respect with which Dr. Killian is held by all those whose fortune has been to share the Killian years at M.I.T.*

Dr. Killian was Managing Editor of Technology Review *from 1927 to 1930 and Editor from 1930 to 1939. The files reveal that his contributions to the* Review *extended beyond those usually assumed of an Editor: he was the author of several articles and a number of reviews, and these show the literary style which characterized the* Review *and assured its success in those years. Frederick G. Fassett, Jr., Dr. Killian's successor as Editor, calls attention to the work which Dr. Killian did in developing and teaching a highly regarded course in magazine editing and production at Simmons College—and to the quality of his own study of typographic design for magazines.*

The "Killian style" survives. John E. Burchard, Dean Emeritus of the School of Humanities and Social Studies, has written that "never, on any occasion at which I have heard him speak, have I heard (Dr. Killian) utter anything that was in bad taste or irrelevant or inappropriate to the occasion. . . . His addresses, big and little, have been thoughtful and considered, responsible, couched in literate English and uncorrupted by an overconcern with metaphorical fantasy."

This quality is made more remarkable by Dean Burchard's finding that since 1945 Dr. Killian has made "at least 899 speeches of various length and import, reaching a peak of 53, or slightly more than one a week, in 1957."

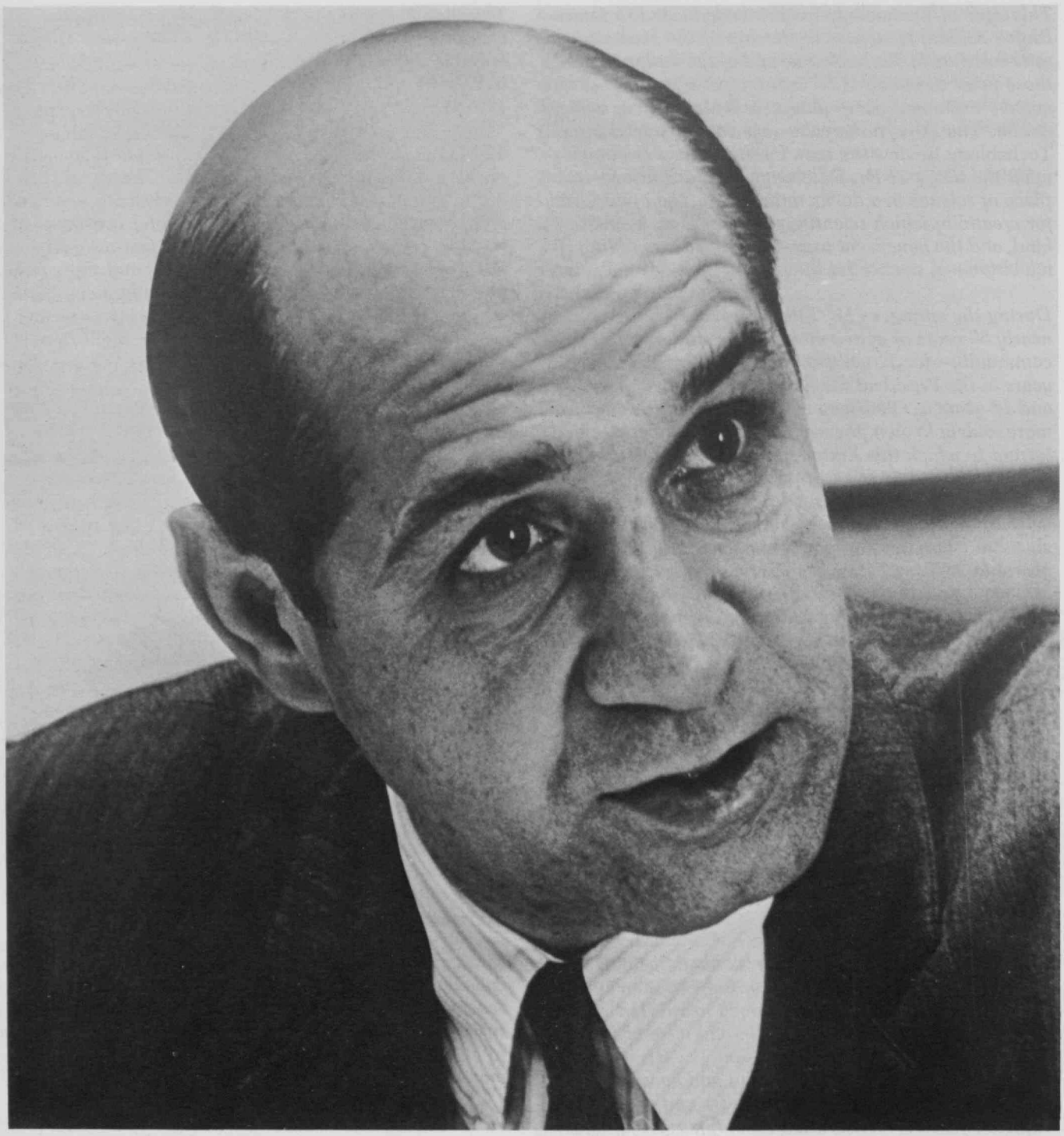
The tribute of the M.I.T. faculty, expressed in a special resolution this spring, is extraordinary: "Never wavering in his belief in the importance of a 'university polarized around science and engineering,' or in his insistence that our particular university must be first-rate, (Dr. Killian) has . . . been a tireless proponent and supporter of experiments in education, always emphasizing quality. . . . He has been a major force in making our community civilized, cultured, and agreeable in all respects —spiritually, physically, and intellectually."

Of Dr. Killian's contributions to the nation, Julius A. Stratton, his colleague as Provost and later President of M.I.T., has said to members of the M.I.T. Alumni Center of New York: "This is a man who knows the real meaning of scholarship and who, I believe, as well as any man in this country, understands the process of education and learning. But equally significant for these times is his deep understanding of what the progress of science and technology implies for the future of mankind and his clear recognition of the part that our institution has to play. . . . His awareness of the potentials of science and his extraordinary sense of responsibility have led to a record of public service with hardly an equal."

Finally, the Editor turns to Howard W. Johnson, who succeeds Dr. Killian as Chairman of the Corporation, speaking at the 1971 Commencement Luncheon: "As the tenth President of the Institute from 1948 to 1959, and subsequently as Chairman of the Corporation, he has directed and guided, through monumental contributions and personal sacrifice, the Institute to its highly respected status."

If asked to choose just one quality to describe his colleague, Dr. Stratton—commenting at a campus reception for the Killians on Commencement Day this spring—said it would be "his unfailing commitment to all that is good for M.I.T. . . . Of him we have demanded much; he has given more."—J.M.

"In the many years when I was intimately involved with both government and science I found no compelling reason to believe that democracy is automatically compatible with either science or technology. I do not know precisely why this should be, but I will risk the hypothesis that it is at least partly due to the fact that democracy is fundamentally an inefficient system. . ."



It is questionable whether the democratic process is capable of arriving at sound decisions when faced with the kinds of public questions that arise in a technologically-based society. The ultimate decision facing our society could be the choice between further technological progress and democracy itself.

Emilio Q. Daddario
Senior Vice President—Gulf and Western
Precision Engineering Co.

Technology and the Democratic Process

Most of us are now aware of the critical social maze which we of the technologically advanced nations have built for ourselves by the uses to which we have put newfound knowledge. But in spite of living in a society which has been rapidly altered by technical change, we are seemingly mesmerised by that persistent human malady, the status quo. We seem to believe that there will be quite enough time for the next generation to change its ways, and that for the time being we can safely run in place—or perhaps even step back a bit.

Putting our predicament in the most fundamental terms, it appears that we are now coming face to face with the ultimate issue posed by the story of the Garden of Eden. Having determined, in spite of warnings, to taste the fruit of knowledge, we are confronted with the task of learning how to live with the consequences of that act.

Let us try to analyze those consequences. The prime elements of the physical and social equations which we must solve—and solve within a time span of only a few decades—are these: the discovery, exploitation and use of this planet's remaining resources; the potential advantages and disadvantages to be expected from such use; the qualities of man himself—his numbers, his crowding, his indecisiveness in deciding national and international long-range goals; man's relationship with other men and with other forms of animal life; and finally—the great unknown in this present exercise—the appropriate role of government in seeking solutions to the major issues confronting contemporary society.

Regarding this last, the big question is not, I believe, *whether* government must assume the prime responsibility here. It is not even *how much* responsibility government must assume. It is the *manner* in which government shall act—and, most seriously, whether or not it will be possible for government to be effective and yet remain democratic.

The Nature of Five Dilemmas

It might help if we take a somewhat closer look at the nature of the dilemmas for which technological change is partly, if not solely, responsible.

The first dilemma relates to economic growth. The American economy, we must remember, is and always has been based on assured growth: growth in per capita income (both money and property), growth in population, growth in the G.N.P. A traditional belief in our country has been that growth is a good thing—and as our population has grown we have assumed that economic growth is necessary to maintain a decent life. This growth has been based for the most part on the exploitation of resources, the production of things, and their quick consumption to complete the cycle of demand so that the economy will not lag.

Yet as our numbers have increased, as our resources have diminished, as our environment has become eroded, the faith has begun to be questioned. Today, there is a growing desire to consider economic matters without assuming, *a priori,* that whatever promotes growth is a good thing. But we have not learned to do without such growth, and I see few signs that we are trying very hard —even though it is quite evident that in the long run we will not be able to tolerate its consequences.

How do we go about resolving this dilemma? If we place a halter by fiat on production, the result would be a lowered material standard of living before our society has learned to substitute other interests, ideas, or services for things which now dominate our economic design. Until such substitutes develop, a drastic change in the system might well prove dangerous to the nation's social foundation (which depends upon a network of implicit agreements as to the worth of things).

That risk is not, however, ultimately avoidable. For if we do not take policy steps to restrain our economy, the eventual exhaustion or misuse of our physical assets can do it for us—and in a harsh way. Realistically, then, the basic problem of our attitude toward growth must be made a political issue of the first order.

The second dilemma relates to our basic political creed. The principal objective of the American government is the extension and preservation of individual freedom. This has been the underlying impetus to our government's evolution from the very beginning. Today we are beginning to recognize that earth is so limited in its resources that our survival may well depend on an increase of discipline regarding the uses to which those resources will be put. An indication of the difficulty we face is that the United States, making up 6 per cent of the world's population, consumes about 40 per cent of each year's supply of the world's processed resources. There are, therefore, moral as well as practical considerations that

Where interests and activities impinge, there is, at best, a mutual limitation on freedom of action. How do we resolve the dilemma of freedom versus growth? . . . Faced with a hard choice between liberty and order, man historically tends to choose the latter.

must concern us; and there are signs from various of the undeveloped countries, where resources are in long supply, that this kind of apportionment cannot continue.

Now these trends run counter to the idea of individual freedom. Why? By way of analogy, notice the facts of ordinary experience, that urban society has more rules than rural, that crowded highways or airlanes or communities impose far more constraints on behavior than do sparse ones. Where interests and activities impinge, there is, at best, a mutual limitation on freedom of action (at worst, the effect is unilateral). How do we resolve the dilemma of freedom versus growth? If the answer is not at once apparent, we might at least note that, faced with a hard choice between liberty and order, man historically tends to choose the latter.

Third, a related but distinct issue: One of the most pronounced objectives of U.S. foreign policy, as expressed by all of our administrations since World War II, has been to promote comity by aiding the less developed nations of the world technologically, in order to help them achieve a rising standard of living. We now begin to perceive, however, that the world's resources are simply not adequate to sustain a general extension of U.S. technology, if the end product is growth and consumption on the scale which we have promoted for ourselves.

This raises a very interesting question. Will we be obliged, for the sake of comity, to reduce our standard of living, which currently depends to a considerable degree upon consumption of raw materials obtained abroad, or will we accept the proposition that a pronounced differential between the developed nations and the underdeveloped nations must continue to exist indefinitely?

Fourth, there is the dilemma posed by what might be called the time constants of democracy. There is often a long time lag between the moment when a technological innovation is first brought into commercial use and the time when its secondary effects are perceived to be seriously adverse. The public, at least in the developed Western civilizations, and especially our own, tends to operate on the basis of short time spans. If a product is marketable and appealing, the public wants it in volume and wants it *now*. Conversely, when the unwanted effects become pronounced, the public insists on quick corrections.

The problem here, of course, is that quick corrections are possible only at the very early stages of technological development, long before the public becomes aware of the adverse effects. So the question arises: Should government undertake to apply these correctives authoritatively and early, without bringing the public into the act, or should events be permitted to run their course, with the attendant eventual public reactions to the side effects of full-grown and therefore hardly curable technologies?

Neither alternative is particularly attractive. The first invites howls of protest from inventors, industry, and the innovative entrepreneurs. The second runs the risk of an issue becoming so charged emotionally that rational efforts to correct the problem—by that time, entrenched

and obdurate—may be almost impossible.

The fifth dilemma which I would like to cite is perhaps a subtle one, yet it is probably as problematic in its own way as any one of those I have mentioned. This problem is based on the fact that, in considering technical problems and issues, the technical community and the general public usually employ rather different criteria of importance. In itself, this situation creates a communication gap which our recent history suggests is not an easy one to bridge, and which will demand a considerable amount of effort and goodwill on the part of both camps to overcome the conflicts which have developed.

To speak of two camps actually oversimplifies the matter, for a scientist, engineer, or technician dealing with matters outside his competence—even when they are technical or scientific matters—will sometimes behave with the emotional lack of discipline of the public.

Assumptions About the Democratic Process

These tendencies pose the following two questions: In dealing with technological issues which require public resolution, must we respond to the emotional and sometimes irrational clamor of the public, or is there some way to sort out the issues and deal with them on a rational basis even though they may have become deeply ingrained in the fabric of everyday life? In the light of the dilemma previously outlined—that of instant public reactions to gradual technical change—we are brought around full circle, and must also ask ourselves whether it is possible to deal with such issues in a rational way without becoming involved in a negation of the democratic process.

In seeking answers to the twin basic questions, How rational must we be? and How rational *can* we be?, it is essential that we take careful note of certain faulty assumptions which—more often than not—have become routine in our thinking. They include, but are not necessarily limited to, the following:

◊ That all aspects of a technological innovation can be foreseen and identified within the scientific community (and, moreover, discussed in public forums);

◊ That quantitative technical data are inherently objective;

◊ That all human values can be quantified, and that most of them can be quantified in terms of monetary value;

◊ That those who will be adversely affected by a technology can anticipate precisely (or at least in a general way) its effects, and make known their dissent; and

◊ That the democratic process can and will unfailingly adjudge the preferred technical course.

One recognizes that to some extent each of these assumptions overlaps the others—and, moreover, that a fairly large number of additional unjustified assumptions can probably be cited. But the point I wish to make here is that we often fail to realise the full, painful complexity of the conflicts which are developing between technology and democracy.

The Democracy-Science Mix

Continuing in the vein of things-are-not-always-what-they-seem, let me observe that in the many years when I was intimately involved with both government and science I found no compelling reason to believe that democracy is automatically compatible with either science or technology. I do not know precisely why this should be, but I will risk the hypotheses that it is at least in part due to the fact that democracy is fundamentally an inefficient system—we sacrifice efficiency to obtain a higher good—whereas in science and technology, efficiency (whether of thought or action) is of the essence.

It would be hard to devise a more inefficient mode of government than a true democracy. I am not aware of the existence of any perfect democracy, in the pure political science sense, but we refer to our republican system of representative government as a democratic one, and that system itself is inefficient enough. The founding fathers made certain of this when they wrote our governing charter at Philadelphia in 1787, and devised the ingenious system of checks and balances which has served us well for 200 years.

Science, on the other hand, is a "discipline," and its various subdivisions—even in the social or "soft" sciences—are referred to as "subdisciplines." Scientists and engineers are successful in furthering their art only insofar as they discover new principles which provide increased efficiency as compared with the foundations upon which they have been working.

Scientists usually distinguish themselves from the general public by their devotion to whatever discipline they practice. At times, however, both the natural and the social scientists become pleaders for a special cause. In their eyes, very possibly, this is all in the further pursuit of efficiency, but all too often such special pleaders adopt methods which are quite inefficient when looked at from outside and judged (churlishly, perhaps) by scientific standards. These methods include self-denial, rejection of promising lines of inquiry, withholding of knowledge from the general store, and adherence to intuitive notions and hypotheses which have been shown to be invalid.

Our democratic system, even in its government-science relationships, makes no effort to stem such behavior. I do not mean to imply that it should. The observation is made merely to corroborate the contention that if science and the democratic system are to work hand in glove, they will probably do so in spite of themselves, and not because of any natural mutual attraction.

As to the use of science and technology for governmental purposes, this is in principle entirely rational, but whereas a tyrannical government is able to impose technical innovations at will, a democracy must rely on the slower processes of education and public choice. The one is efficient, the other time-consuming and inefficient.

How can we employ science and technology on an ever-increasing scale without departing from the democratic philosophy? Frankly, I do not know if this can be done—given the enormous mass and pressure of society with which we must now contend. But I like to think it can . . .

At the same time, no one is gifted with perfect rationality. The arbitrary dictator can err as can his democratic counterpart. Partly for this reason our system is inclined to award power sparingly. Resistance to authoritarian power is deep in the American tradition—and it manifests itself in the rejection (from time to time) of needed rational authority, as well as of the irrationality of power which is an end in itself. Thus there are occasions when we tolerate irrational excesses of behavior when the rational alternative would be to crush them in an authoritarian manner which would seem a greater evil. Conversely, we may allow a defect to grow and swell until it becomes intolerable, and then, with equal irrationality, overreact and demand an authoritarian quick fix which will soothe our feelings but which may or may not have any real therapeutic value.

Science Policy and the Democratic Future

With this brief examination of at least a few of the problems, inconsistencies and dichotomies which plague the interface between technology and the democratic process, we arrive at the stage of "issues-to-be-faced-immediately."

First: Shall we attempt to find solutions for the major dilemmas facing civilization without enlisting the help of more and improved science and technology?

Second: If not, how can we employ science and technology on an ever-increasing scale without departing from the democratic philosophy?

Third: If the answer to that is, "We cannot," what do we do? Revert to pretechnological communal living, or junk democracy and adopt other values and more efficient systems of government?

It seems to me that the first question can only be answered in the negative. Without the support and continuing development of technology our modern civilizations could do little but collapse, much in the same way as the astronomers describe stars collapsing into white dwarfs, neutron stars or perhaps even "black holes" when their life energies give out.

This is true, I believe, in spite of the fact that until about 1950 our nation had no science policy worthy of the name. Our democracy had simply been unable (or, more likely from an historical perspective, unwilling) to enlist science on its behalf in any comprehensive way. After the post-World War II debates dealing with nuclear energy, and the creation of the National Science Foundation, we turned to the support of science as a general policy. We were motivated by remembrances of that war and of the depression which preceded it—plus the great role which applied science played in bringing those eras to reasonably happy conclusions. Indeed, we began to regard science as the solution to all problems then foremost in the public mind—as we did to an ever greater extent a decade later when we were startled out of our technological wits by the launching of Sputnik.

But these problem attitudes change. Science and tech-

nology cannot always be represented as the immediate or even ultimate solution to all public problems. If they are a part of our culture now, and their methods do indeed suggest ways of solving problems, they can nonetheless become highly suspect in the public mind in a very brief historical span. Some of our current environmental agonies attest to this.

Which brings me to the second issue: employing technology positively and in a manner consonant with our traditional democratic concepts.

Frankly, I do not know if this can be done—given the enormous mass and pressure of society with which we must now contend. But I like to think it can, and I would suggest that perhaps a broad-scale capability in technology assessment is the key.

I am not speaking here of the small, highly skilled task groups in technology assessment which are formed to undertake a specific task for some governmental agency. That is important, obviously, but what I am referring to is the gradual, consistent education of the public to perform the kind of town-meeting assessments of technology which must be done for almost any community development in this day and age.

This is not new. The process has been and is going on at various times and places throughout the land. The element which must be added is one of higher sophistication and interdisciplinary vision. Over all, there must be a realization that the process *is* an assessment, and that to be useful, it must be inclusive.

The point is that technology assessment, in all public problems involving technical matters, requires a number of forums: the professional community, the congressional committee, Congress as a whole, the executive agency, the courts, the special interests, and the public at large. The crucial part of all this is that the Congress, from the standpoint of government, is the final forum—and the Congress reflects the attitudes arrived at in other forums as well as its own, especially that of the public. Since the public forum not only has great influence, but is perhaps the one most prone to respond to emotional stimuli, a sharp awareness of this need for some kind of public grasp of technological matters, and public training towards it, seem to be the best answer we have.

Not infrequently, in the past, emotional reactions have managed to provide good answers. But if one studies the history of the handling of technological problems by the government, it becomes fairly clear that the batting average of this method is no longer good enough. Our margin for error is diminishing by the day.

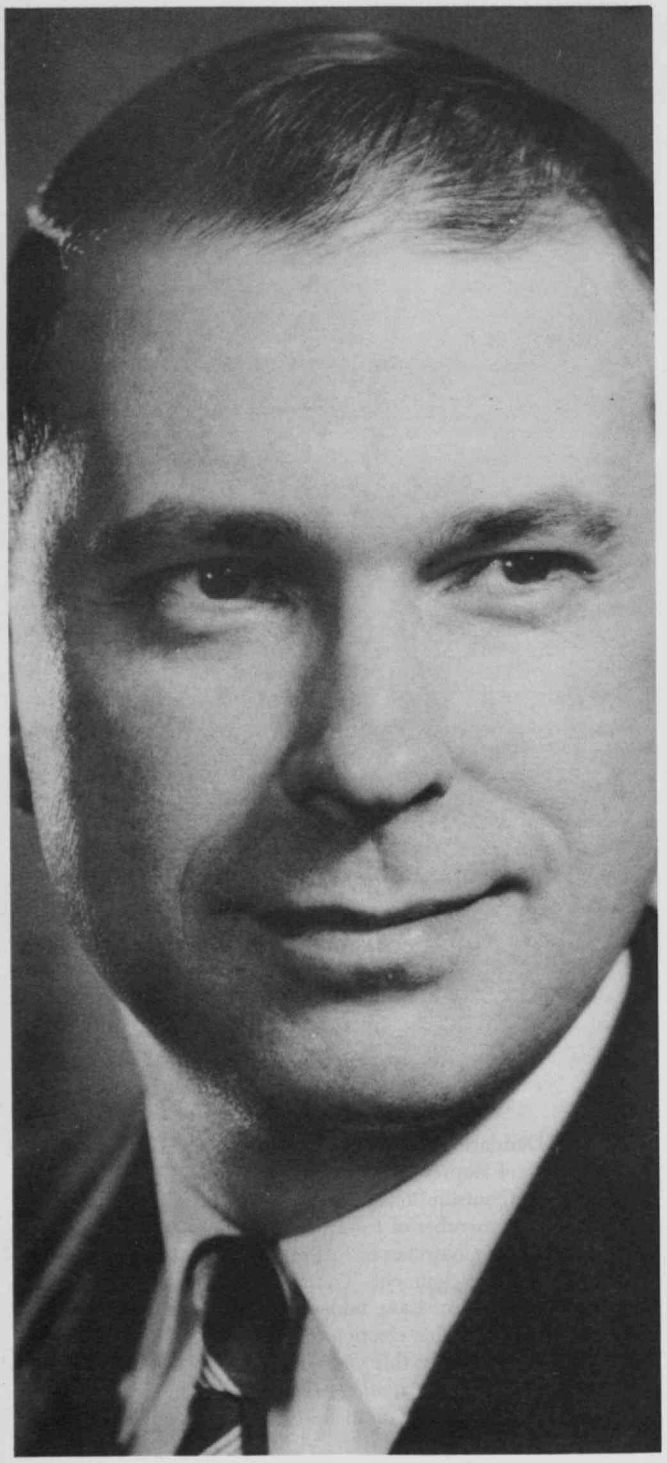
As for the third issue—where we turn if we cannot make technology serve our purposes without obliterating our democratic values and institutions—this I leave to conjecture. I find the prospect of abandoning democracy most distasteful. Democracy may be inefficient, but for the people it serves it can be effective and satisfying; and that, in the long run, is crucial. Meanwhile, one must keep in mind that the pragmatists, who plan for any contingency and who seek only to survive, may not recognize the magnitude of the values they will eschew if they turn democracy out to pasture. Therein lies much danger.

Emilio Q. Daddario represented the First District in Connecticut in the House of Representatives from 1958 to 1970; he won distinction for contributions to federal science policy throughout this period as a member of the House Committee on Science and Astronautics and Chairman of its Subcommittee on Science, Research, and Development. Trained at the University of Connecticut School of Law, he led an active practice in Hartford, Conn., prior to his election to Congress; he has held his present post since early this year. This paper has been developed by Mr. Daddario for *Technology Review* from his 1971 Pollak Lecture to the John Fitzgerald Kennedy School of Government of Harvard University.

In five years public television has become an insistent example of the benign use of technology. The future holds still greater opportunities to serve freedom and the social good.

Hartford N. Gunn, Jr.
President, Public Broadcasting Service

New Technology for Public Communications



Two "big birds"—one a yellow-feathered fowl that cannot get off the ground, the other a metallic grey synchronous satellite—are now vital to the future of American public television. The big yellow bird is from *Sesame Street*. It may never reach Main Street in remote areas of Alaska, Montana, Wyoming, and many other parts of the United States without a little help from a mechanical friend—a high-powered domestic satellite.

Even with the largest number of stations of any American network, public television covers only three-quarters of the country's area. Without excellent innovative programs, hard-to-reach audiences might never justify the cost of being reached. The critical challenge of public television is to combine most effectively technology and programming to educate, enlighten, and entertain.

Five years ago, as Chairman of the Carnegie Commission on Educational Television, James R. Killian, Jr., perceived this very clearly. His Commission anticipated the great debate over communications technology and public policy—a debate that has since launched a Presidential Task Force, Federal Communications Commission inquiries, and Congressional hearings on broadcasting's structure, policies, content, and social consequence.

The Flowering of Public Television

Over the past five years, the Carnegie Commission's recommendations on behalf of public television have in large measure been achieved. In November, 1967, less than a year after the Commission issued its report, the Congress passed the Public Broadcasting Act, creating the Corporation for Public Broadcasting (C.P.B.). In the past three years, the Corporation has given central purpose to the development of the public television system. It has distributed funds to local stations across the country. It has designated eight "national" production centers in Boston, San Francisco, Los Angeles, Pittsburgh, Washington, Chicago, and New York—the latter with both the Children's Television Workshop, producers of *Sesame Street*, and N.E.T., now merged with station WNET in New York. Nearly 150 public television stations are now interconnected on a live basis 25 hours a week by a national network, the Public Broadcasting Service (P.B.S.). Soon the 204 noncommercial television stations will be joined to a

network available 24 hours a day.

Public television in the United States is coming to full flower with better and more diverse programming. This May, *The Andersonville Trial*, a drama produced by KCET in Los Angeles, won an Emmy as the best television program of the year. *Civilization* has won popular and critical acclaim. Public television stations now carry the two most acclaimed children's television programs, *Sesame Street* and *Misteroger's Neighborhood*. P.B.S. also offers serious drama: the B.B.C.'s *First Churchills* and the *Forsyte Saga;* the home-grown *Hollywood Television Theater*, produced by KCET in Los Angeles; and *N.E.T. Playhouse*. Opera may be even more alive and well on public television than in live performance. Classic works are being restaged and directed especially for television production. One opera, *Queen of Spades*, was recently presented with stereophonic sound by coordinating the television performance with the local noncommercial radio stations.

Despite the successes of the past five years, the most critical piece of work charted by the Carnegie Commission remains undone—the securing of an adequate and *permanent* financing for public television. The Carnegie Report recommended that the proceeds of an excise tax on the sale of television sets be paid into a trust fund administered by the Corporation for Public Broadcasting. This fund would generate, it was estimated in 1966, more than $100 million a year, the amount that the Commission deemed necessary to operate an adequate public television service. Unfortunately, the Congress did not approve the concept of a trust fund as part of the 1967 Act. The Corporation for Public Broadcasting has been relying on the annual appropriation process to secure its funding. Although the level of funding has increased from $7 million in its first year of operation to the $23 million which was allocated for fiscal year 1971, the sources of revenue continue to be far short of what is needed.

If there is no question that much higher funding is needed and justified, there is also no question that these funds must be insulated from political pressures. The public communications system that develops in the United States must be free of the meddling that characterizes many foreign broadcast systems whose charters and funds derive wholly from the state. Public affairs programming must enable the public to grapple with both the substantive complexities of issues and the intricacies of the processes required to bring about change.

Encouraging Innovations in Technology

This discussion of the responsibilities of public television—and of the broadcasting media as a whole—is important and timely background to a discussion of how new technologies will change the types of programming produced and the audiences that can be reached. Cable television will increase the number of channels of information available to the public and facilitate programs by and for minority groups. Cassettes may radically increase the viewer's choice of time and content of television programming and exponentially increase the medium's educational potential. Satellites may lower the costs of national interconnection, bring more live events into American homes, and make possible a national or regional university of the air during evening hours.

As part of the Carnegie Commission's Report on Educational Television, Joseph C. R. Licklider, Professor of Electrical Engineering at M.I.T., prepared a study entitled "Televistas: Looking Ahead Through Side Windows." The report depicted the potentials for what he termed "narrowcasting"—telecasting to smaller, more specialized audiences. He foresaw, as well, the use of interactive technologies which would transform audiences from passive watchers to active participants in television programs.

These "televistas" are now nearer to fruition. They challenge those who manage the institutions of public television to ensure that today's regulatory proceedings encourage rather than inhibit tomorrow's innovations. More public advocates with scientific and technical backgrounds will be needed to argue that important decisions of public communications policy should be based on more than narrow business considerations. They may, like Dr. Killian, come equipped with the experience and skill gained over the years in academic and governmental circles, or they may rely on idealism and ambition of those beginning their careers.

This process of advocacy before the regulatory commissions and other bodies setting communication policy is already underway in several important areas of public policy. Classic legal briefs are not enough. Presentations in the recent F.C.C. inquiries on cable television and domestic satellites have been based on a hard, independent *technical* analysis of the issues.

Against this background, it may be useful to outline in some detail the potential relevance to American public television of at least three new technologies available in the coming decade: satellites, cable, and cassettes.

Public Television by Satellite

The discussion of the future of the domestic satellite system has, from its very beginnings, been related to the future role of public television. The Ford Foundation's filing in the domestic satellite inquiry in 1966 proposed that the cost savings reaped by the major commercial networks and by other users be used to finance noncommercial television. In the current satellite inquiry, C.P.B. and P.B.S. have jointly petitioned the F.C.C. for the free use of two satellite channels and some occasional service for noncommercial television.

Moreover, since the initial Ford proposal, it has become clear that the central issue is not only the free use of channel capacity—essentially a matter of economics and public policy—but the critical issue of the overall technical configuration of the system. All of the satellite applicants to date have oriented their service proposals toward the needs of the primary commercial customers. Under those conditions, many noncommercial public users—noncommercial television stations, hospitals, schools, and other public institutions—may

The high-powered domestic relay satellite relay is one of two "birds" on which the future of public television in the U.S. rests, says Hartford N. Gunn, Jr., President of the Public Broadcasting Service. Provided they are designed to deliver signals to low-cost receivers, satellite distribution systems can have an enormous future effect on the availability of high-quality television programs, he writes.

not be able to afford the cost of receiving equipment.

But the satellite system can—and should—be designed to deliver a signal to an extremely low-cost receiver, one costing about $1,000, rather than the $100,000 that many of the applicants have proposed. Technical studies commissioned by P.B.S. have found that such equipment designs are feasible, provided that the power of the spacecraft and the frequencies used are selected with these public users in mind. Likewise, in a related F.C.C. inquiry preparatory to the World Administrative Radio Conference—which will assign new frequencies for communications satellites—C.P.B. and P.B.S. worked to reserve exclusively for non-commercial public users the 2500-2690-MHz band, where the desired low-cost operating equipment can be used.

Cable Television: Crucial Questions

At the same time the F.C.C.'s inquiry on the future of cable television has been closely watched, and the development of cable television may now be said to have reached a critical stage. For the past 18 months, the F.C.C. has held intensive rule-making inquiries on a set of basic regulatory questions. These concern the ability of cable operators to import signals of broadcast stations operating in distant cities into the top 100 television markets. The F.C.C. is also debating what level of government should regulate cable television.

But despite the importance of who regulates cable television and whether distant signals may be brought in, the critical questions for public broadcasting may be quite different: What will be the likely channel capacities of cable systems, and will they offer two-way communications?

Despite earlier promises of 60 and 80 channel systems, the cable television operators seem to have decided that installing a system larger than 20 or 24 channels is a bad economic investment. This decision is disillusioning to those who are most interested in seeing the development of wide educational uses for cable and neighborhood-level access to cable systems. Only when large packages of channels are available will it be possible to repeat programs and to simultaneously deliver several courses in an "open university" curriculum.

Five years ago, Dr. Licklider foresaw the benefits of cable's narrowcasting and interactive capabilities. Unfortunately, current cable systems, almost without exception, are designed only as a one-way distribution system for television signals. These systems will not meet the future needs of the educational community; and nobody seems concerned with calculating the costs of converting them to do so once they have been installed in the larger cities. As has been the case so often, a vision of the future potential has been blurred by myopic implementation.

There remain a few opportunities to remedy the situation. In the top 100 markets, public groups are just beginning to participate in the franchise proceedings.

A few public-interest lawyers are insisting that franchise arrangements guarantee community groups access to the cable channels, provide for "neighborhood-level" production facilities, and work out some stable source of revenues to support programming. Engineers and economists will be needed to conduct economic and technical studies on the feasibility of extending the channel capacities and interactive capabilities of systems. This work is being done and must be done on a local level because the franchise-granting process is bound to remain decentralized.

The Coming Cassette Revolution

The third major new technology being assessed for its significance to public television is the videocassette. Uncertainty about the cost and feasibility of various home video systems clouds all analyses. It is unclear whether any of the early promises of low-cost play-back-and-record units will ever be realized. The videocassette may turn out to be a device that only large educational and governmental institutions can afford. Nevertheless, it is important to consider at this early moment in the history of the cassette whether music, drama, and cultural programming will some day be on cassettes, to be played by the viewer whenever he wishes to watch them.

Various patterns of delivery of cassette programming to the home may develop. If television sets are routinely equipped with recording capability in the future, the traditional television networks may deliver materials to a viewer for taping and later use as he wishes. But if retail or mail distribution of cassettes becomes common practice, then television networks may broadcast mainly news and public affairs into the homes and schools of America.

Videocassettes will vastly increase the capabilities of television in the areas of training and education. But it is important to remember that they offer only limited capabilities for interaction with the audience.

The advocates of the cassette revolution, as it has been called in the popular press, have yet to integrate their view of the technologies of broadcasting, cable, and cassettes as complementary rather than competing media. Yet one union of these two technologies seems obvious. So long as the cost of home play-back units remains high, the economics of the situation will favor some concentration of the videotape players in video libraries; and the operation of these libraries could well become a new function of the public television stations.

If these video libraries are created, groups of cable channels can be used as a delivery system over which viewers could schedule the programs they want to see. This type of service may not even await the installation of two-way cable systems or the dawning of the age of "computer television" predicted by far-sighted observers like Paul Klein. By using telephone lines as the return channel and some type of computerized reservation system, viewers could indicate program preferences for scheduling over a block of perhaps eight to ten channels reserved for this purpose. Thus control over the schedule of the local station could be placed in the hands of viewers.

Modest experiments along these lines are already underway in both the United States and Canada. In Ottawa, teachers schedule the use of instructional TV programs by telephone. The programs are placed on tape recorders, played at the times requested by teachers, and delivered by cable.

Home video players increase the viewers' choice of television programming. Yet the cost of the various systems may block their development altogether unless viewers are willing to settle for less than maximum choice. The video library may be a feasible and desirable compromise.

The concept of a video library system is an important one for public television. But technical assistance is needed from engineers interested in promoting these innovative schemes if such video libraries are to come into being.

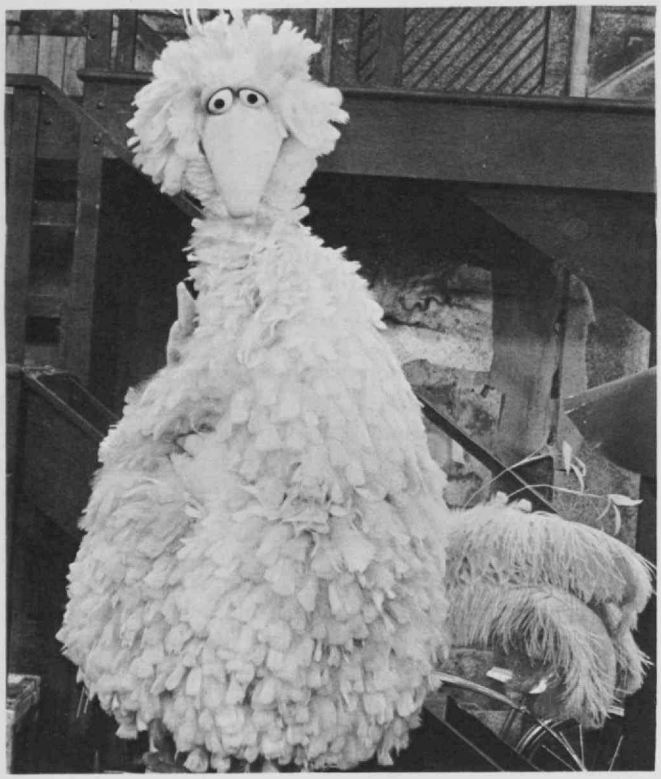
Toward the Video Magazine

To reiterate an earlier point, the changing capabilities of the new technologies will lend new meaning to the communicator's responsibilities to insure fairness, objectivity, and accuracy of programming. Indeed, new technologies may change the video medium into one similar to the print medium.

In medieval times, the written word—and hence much that was communicated—was controlled by the medieval priesthood. With the invention of the printing press, control over the reproduction and distribution of books shifted to a wide group. As the technology of the printing press changed and the flow of information increased, so did the rules and regulations governing content. An analogous evolution may now be occuring with television technology, the broadcast establishment acting as the twentieth-century priesthood.

As a result of these changes, it is not impossible to foresee a variety of video magazines springing up as diverse as their print counterparts on the newsstand. Perhaps individual consumers will be able to buy or rent such magazines, if the economics of video "publishing" turn out to be comparable to that of the traditional printing industry. It is at least as likely that economics will favor the establishment of video libra-

Given some help from a properly designed satellite system, the big yellow bird of *Sesame Street*—one of public television's most successful programming innovations—may presently find his way into even the most remote corners of the U.S. Today—without satellite help—public television reaches only 75 per cent of the area of the U.S.



ries, with home delivery service offered over cable channels. A billing system for ordered programming will have to be devised by the entrepreneurs and public policy analysts. Currently, such a system would run up against the regulatory barriers which bar subscription television, however.

Ultimately the shift in technology will press against traditional regulatory notions and against the existing economic strictures of the television industry, in both its public and private sectors. As consumers begin to pay for programs, the undifferentiated "mass" audience can be treated as the series of distinct publics that it is. With the market providing substantive program choice, the need for rules and regulatory restraints on content and format will begin to diminish. Technology and economics will transform the electronic media's ability to encourage freedom of expression. The social impact of the media will have changed.

In summary, an overview of the communication system emerging during the next two decades begins to emerge. Satellite distribution systems will be used for simultaneous coverage of important public events. They may make possible regional open universities granting college degrees. They may be the backbone of a public telecommunications system for communication between minority and ethnic groups throughout the country. Satellites will interconnect not only traditional broadcast stations but large multi-capacity cable systems carrying multitudinous locally produced programs and educational materials as well.

New neighborhood-level production centers, essential elements of cable systems in the larger cities, will be joined to the national communication system through "network access points," which may be centered in the existing non-commercial television stations. The old non-commercial broadcast stations may emerge as "telecommunications centers," coordinating special-interest programming by neighborhood production units and even setting up special-interest national networks.

On a city-wide basis, the public telecommunications centers could serve as a metropolitan area "network" for neighborhood-level television centers. Programs done by one small community could be of interest in the outlying suburban areas and could be "broadcast"—or made available through the network—on the over-the-air system to neighboring communities.

It has already been suggested that the cassette players may be concentrated in urban video libraries. As the technology increases, the national network service may make this library system even more flexible and responsive. For example, local libraries could turn in special programming requests to a national archive, which could deliver programs—perhaps over a network—for recording.

Toward the Global Television Service

Finally, the use of international satellites will encourage new patterns of cooperation between American public broadcasting and broadcasters around the world.

In the past decade, multi-national television networks have sprung up. In Western Europe, news and public affairs programs are being exchanged daily over the Eurovision network, and even the Eastern European countries are joining in through their Intervision network. Television has again shown its power to bridge differences between cultures, political systems, and ideologies.

Unfortunately, the world-wide exchange of television programs has not been expedited by the establishment of the international satellite system. The bulk of satellite television transmissions have served the three commercial networks: their news services from Europe and Vietnam and their sports programming to Hawaii and Puerto Rico. Few programs have been exchanged outside the Atlantic basin. Nevertheless, this spring, broadcast organizations from Latin America, Spain, and Portugal have banded together to negotiate special low satellite rates and are operating a daily, live news co-exchange between the two continents.

There are thus some hopeful signs, but the scope of the exchanges must be widened and more pressures brought to bear for special international television tariffs both for the satellite and the land line connections.

Since the early 1960's, the foundations for a global satellite system—technical and institutional—have been laid with the active encouragement of the United States government. Negotiations on the permanent structure of the Intelsat Consortium are now nearly completed after long years of talk.

As the culmination to nearly a decade of dedication to the ideal of a global communications network—and as an appropriate act at the American Bicentennial symbolizing America's role in the international community—I propose that the American government should underwrite the use of these new technologies and institutions to operate a global television service for an initial three-year period. By early in 1972 the President should convene—through the offices of the United Nations—an international meeting of national broadcast executives and heads of international organizations in broadcasting and education. This conference would set the structure and priorities of the global television service.

Independent of commercial and governmental pressures, this global television service would be managed by a world-wide consortium of broadcast organizations. Each participating organization would offer to the network programming representing its culture and society. World events—state visits and addresses, major national political functions—would be covered as they happen. More mundane, daily happenings—often not calamitous enough to count as "foreign news"—could be transformed into "world events" by the presence of the world television service. The inevitable bias of the news media in international reporting towards wars, strikes, earthquakes and revolutions could be partially offset by a serious effort to balance the coverage between continents and between events and mere happenings.

This continuous programming might stir a new awareness throughout the world of its wholeness—a kind of new global feeling only once duplicated when millions and millions of people shared simultaneously the experience of men walking on the moon. Perhaps most important are the unforeseen moments when simultaneity of experience will have irreplaceable value—the times of international crisis. Farmers, laborers, scientists, governmental officials, poets, and even dissidents can get to know their counterparts in other countries.

From a broader perspective, a global television service initiated for the 1976 Bicentennial would symbolize the historic American commitment to the free and open exchange of ideas. And for the first time, satellite communications could be used as an open window—a window on the world for Americans and a window on America for the world.

All this may seem a grandiose dream compared with the tough-minded analysis with which the current public broadcasting enterprise was launched in 1966 under Dr. Killian's direction. But the aspirations then were the same as now. The progress of the past years—toward a national system of public-interest communications—gives reason to aspire so high.

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Hartford N. Gunn's life in television began at WGBH, Channel 2—Boston, when he completed work at the Harvard Business School (M.B.A.) in 1951. He was Vice President and General Manager of the station, operated by a consortium of Greater Boston educational institutions, for 13 years beginning in 1957; and the distinction which he gave to WGBH made Mr. Gunn a natural choice to lead the Public Broadcasting Service when it was founded by Congressional action in 1970.


PRICE THEORY

The U.S. government's pyramiding investment in research and development in the 1950's invoked the law of supply and demand,say Dr. Herbert Hollomon (seated in photograph) and Alan Harger. The loser was American industry—unable or unwilling to compete. Can we now restore to research its true value and to American industry its tradition of technological innovation?

J. Herbert Hollomon
Consultant to the President and Provost of M.I.T.

Alan E. Harger
Administrative Assistant to Dr. Hollomon

America's Technological Dilemma

During these times of rapid change, of the increasing awareness of social problems, of declining trade balances, of inflation, and of unemployed scientists and engineers, thoughtful attention must be directed to the science and technology policy of the U.S. One important aspect of this policy has to do with the way in which technology is used by society, particularly how it affects civilian or industrial activity.

Many people have struggled to quantify the influence that new technology has upon industrial development, economic growth, and social advance. Qualitatively, the dependence of a modern economy on the use of new technology is accepted: technology becomes embodied in more effective production machinery, in more skilled labor, and in products and services that better serve social needs. The direct connections between research and development, and the resultant particular practical benefits, are more difficult to specify. However, it is these connections which must be understood if science policy (national or corporate) is to be effective.

In any attempt to assess the direct consequences of investment in research and development, it must be clearly established that the particular investment has been directed toward the purposes which are being considered. For example, suppose we are looking for the sources of general economic health in the nation; we must recognize that the research and development which have been aimed toward space flight and defense are unlikely to have had as significant an influence as an equivalent research and development activity directed toward, let's say, improvement in productive efficiency in the automotive industry.

Clearly, the effects of research and development on a nation as a whole cannot be understood without distinguishing among the various economic sectors. In the United States, for example, where most workers are engaged in service activities and most research and development is devoted to manufacturing, the overall rate of change in productivity cannot be expected to correlate with the amount of national civilian-oriented research and development.

Other factors influence the consequences of research and development. Most important is the delay, of almost indeterminate length, between an investment in research and development and the appearance of its results in the world. Some recent studies have indicated that this time delay has shortened, but even so, any major new technological development does not diffuse throughout the society in less than five to ten years.

In a recent analysis, Harvard's Richard B. Freeman has found (after taking the time delay into account as best he could) a good correlation between the growth rates and profitabilities of different industrial sectors and the research and development that were performed in those sectors in prior years (1). Figures 1, 2, and 3 illustrate

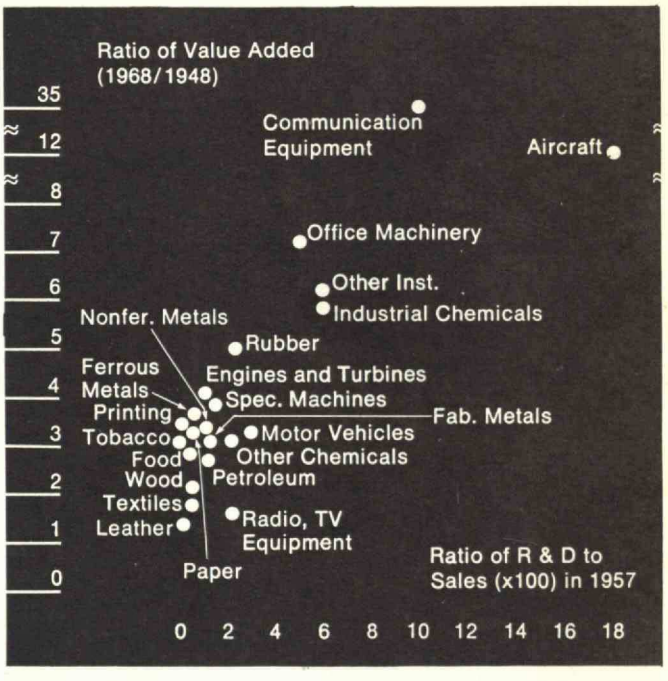
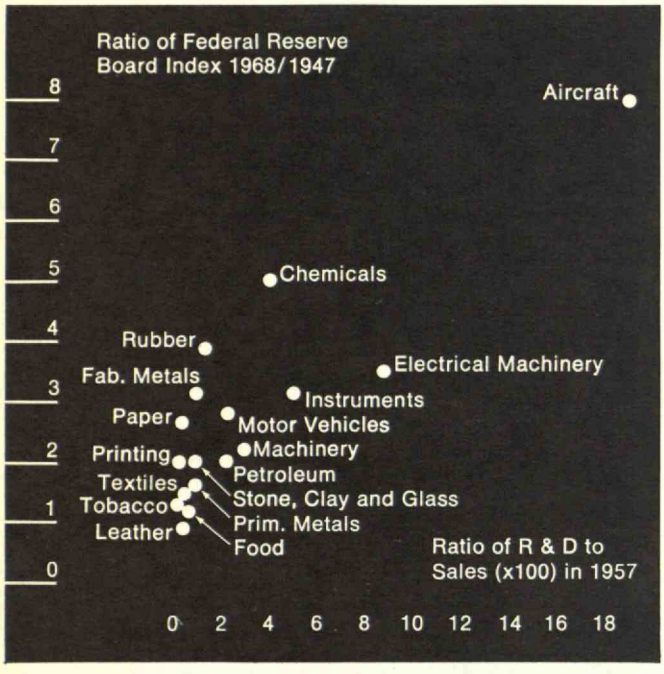


Figure 1. The gross association between research and development intensity and growth in output in various industries is shown here and in Figures 2 and 3 (on the following page). Research and development intensity is indexed by the ratio of R. and D. expenditures to sales. In Figure 1, increases in value added—a term denoting the difference between the value of a manufactured product and that of the starting materials—indicate output changes unadjusted for price increases.

Figure 2. The association between research and development intensity and growth in output in various industries (cont.): in this plot, output increases adjusted for price changes are measured by increases in the Federal Reserve Board Index of Production, and R. and D. intensity is indexed as in Figure 1.



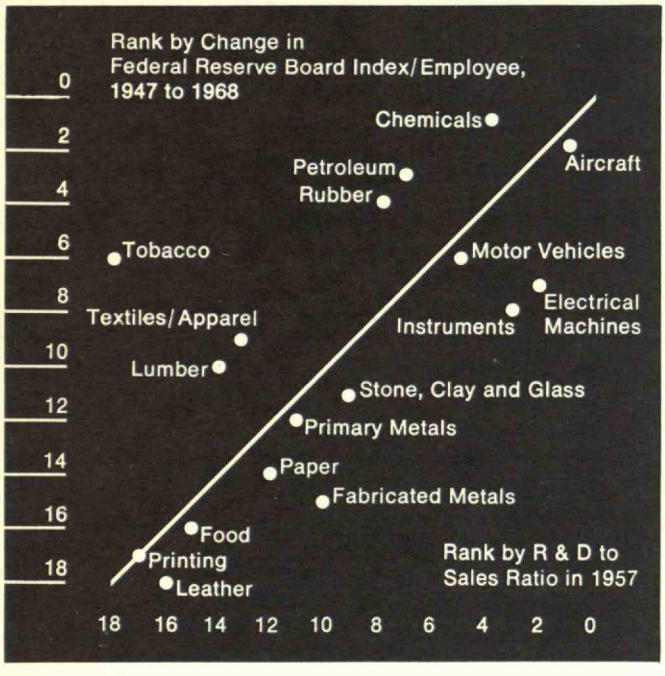


Figure 3. Changes in labor productivity are measured by the industries' indices of production (*see above*) divided by their number of employees. The rank-order relationship in this figure—like the relationships in Figures 1 and 2—indicates a positive and significant *correlation* between growth in industrial output and research and development intensity. (The three plots are after Freeman, ref. 1.)

the correlations. Professor William N. Leonard, of Hofstra, has shown that research and development spending by companies (excluding federal research and development) relates significantly to growth rate of sales, assets, and net income, in 16 industries which, combined, perform nearly all manufacturing activity (2).

Since World War II there have been many other analyses, both for particular industries and for the economy as a whole, that relate the effects of research and development to their economic consequences. It is clear that, for our type of national economy at least, industry under-invests in research and development relative to the total social return it generates in comparison with alternative investments. This under-investment arises because an individual firm cannot appropriate all of the benefits of any new technical development, but must bear most of the cost of that development. In other words, many of the results of a particular development are not of direct benefit to a firm, but indirectly affect other firms that use the results of the development. Furthermore, when a development is highly risky, a firm may forego investment in it because of the cost of failure, even though the rewards of the most probable outcome would fully justify the investment. Or to put the matter another way, individual firms will underinvest in order to minimize their risk, even though the expected rewards from investment in development, on an average basis for many firms, could be quite high. This situation becomes more serious the larger the initial development cost and the more radical the new technology. For instance, in the development of nuclear power the risk may be such that no firm exists with the capability of investing at the early stages of the technology. Only society as a whole can afford the risks or the uncertain costs resulting from technical uncertainty.

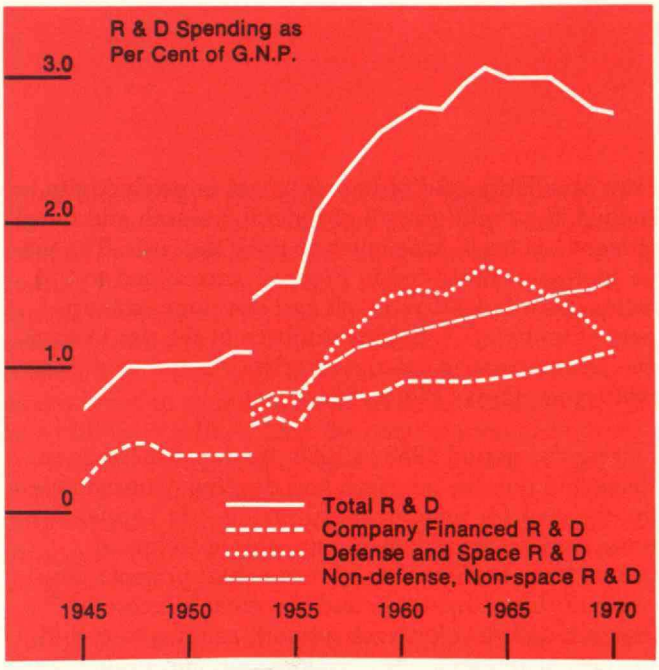
A summary of these studies of the effects of research and development, commissioned by the National Science Foundation (3) indicates that the contributions of research and development to economic growth and productivity, even with this under-investment, is positive, significant, and high.

Industry vs. Space and Defense

During and following World War II, the United States invested heavily in research and development, as illustrated in Figure 4. The most rapid increase occurred between 1953 and 1959, and resulted largely from increases in federal funding (Figure 5); since 1964 there has been a decrease in total effort relative to the G.N.P. It is clear that, as the federal government began to invest more and more in research and development, industry did not follow suit as rapidly; and that, conversely, as the federal government investment decreased, industrial investment in research and development tended to rise.

The recent growth of the U.S. research and development effort is less dramatic when measured, not in dollars, but in the number of the scientists and engineers involved (Figure 6). The costs of technical work have risen much more sharply than the general

Figure 4. Research and development spending in the U.S. since World War II. (Sources: 1945-1953 figures—Office of the Secretary of Defense, in the Census Bureau's *Statistical Abstract of the United States—1960,* Washington, 1960; 1953-1970 figures—National Science Foundation's *National Patterns of Research and Development Resources,* NSF 70-46, Washington, 1970)



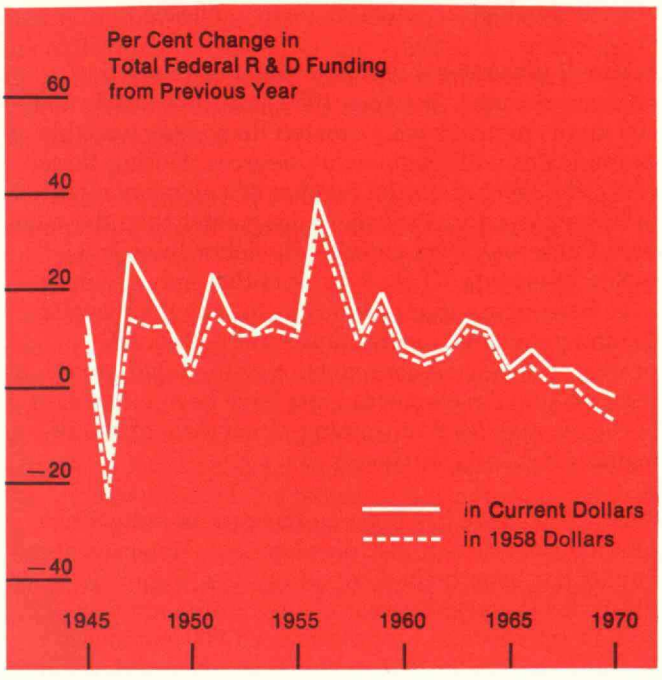
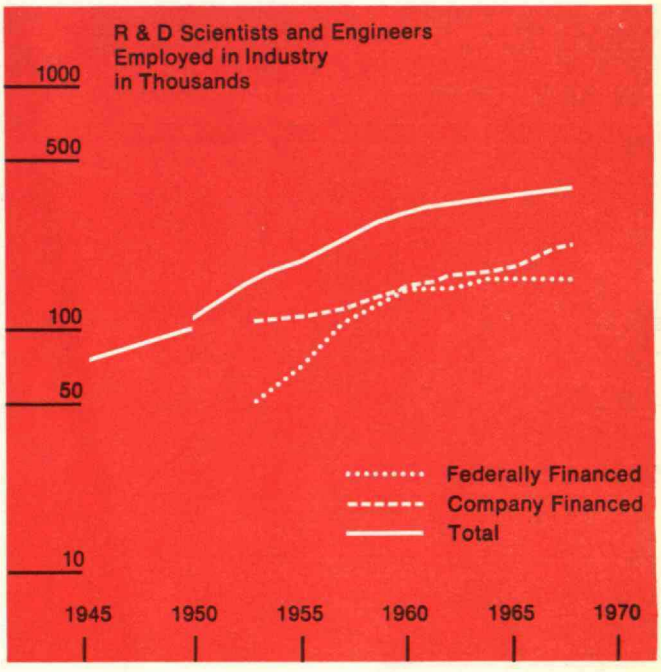


Figure 5. From the same data used in Figure 4, the year-to-year changes in total federal research and development support are shown. ("1958 dollars" were arrived at using the implicit G.N.P. deflator, since there is no specific R. and D. deflator available.)

Figure 6. Post-war growth of research and development in industry in terms of the number of scientists and engineers employed. The 1953-1961 company-federal estimates are by the authors, and 1962-1968 company-federal estimates are from the National Science Foundation. (Sources: 1945-1950 figures—Department of Defense, *The Growth of Scientific Research and Development,* Washington, 1953; 1950-1957—National Science Foundation (jointly with Bureau of Labor Statistics), *Employment of Scientists and Engineers in the United States, 1950-1965,* NSF 68-30, Washington, 1968; 1958-1968—National Science Foundation, *Research and Development in Industry—1968,* NSF 70-29, Washington, 1970.)



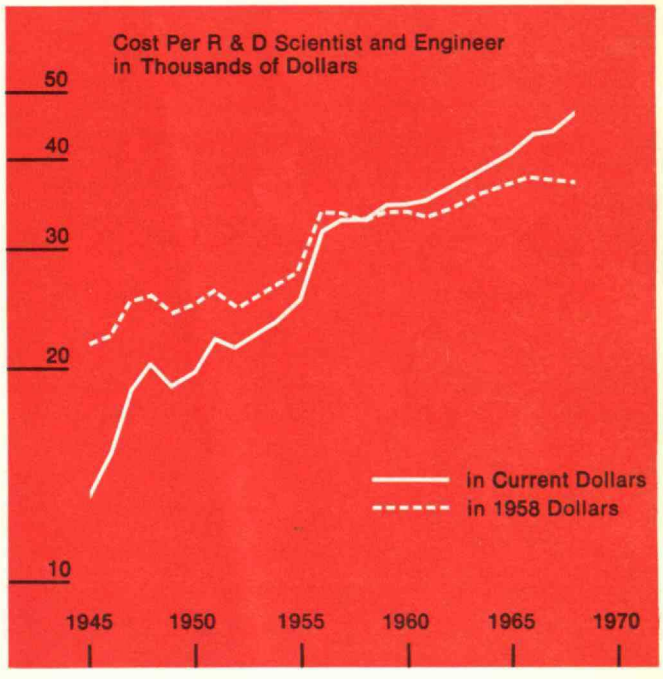
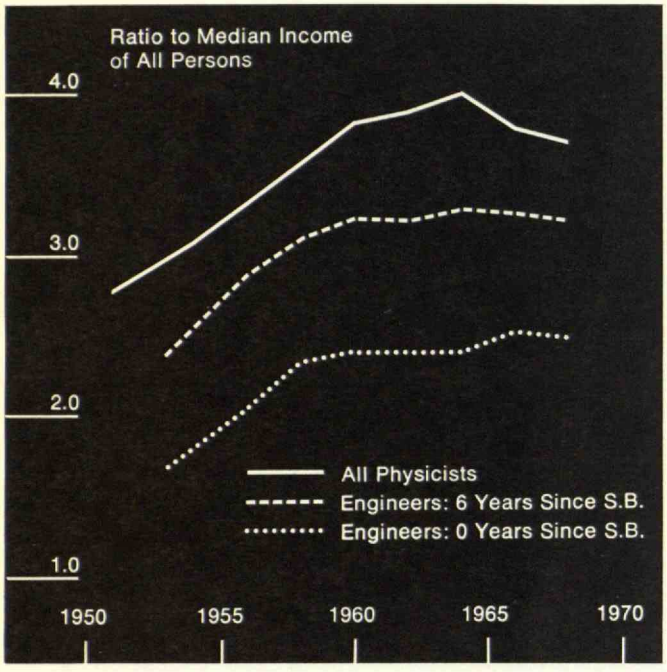


Figure 7. Increases in the cost of research and development per R. and D. scientist and engineer in industry coincide with the increases in federal support traced in Figure 5. (Sources: 1945-1952—Department of Defense; 1953-1956—National Science Foundation/Bureau of Labor Statistics; 1957-1968—National Science Foundation)

Figure 8. Salaries of physicists and engineers as a ratio of the median income of all persons. The rapid rises of the 1950's were a dominant contribution to the cost increases shown in Figure 7 (Sources: median income—Census Bureau's yearly *Current Population Reports, Series P-60 (Consumer Income)*, 1951-1968; engineers—Engineering Manpower Commission, *Professional Income of Engineers, 1970,* New York: Engineers' Joint Council, 1970; physicists—American Institute of Physics, *Physics Manpower—1966* and *Physics Manpower—1969,* Publications R-196 and R-220, based on data from the National Science Foundation's National Register)



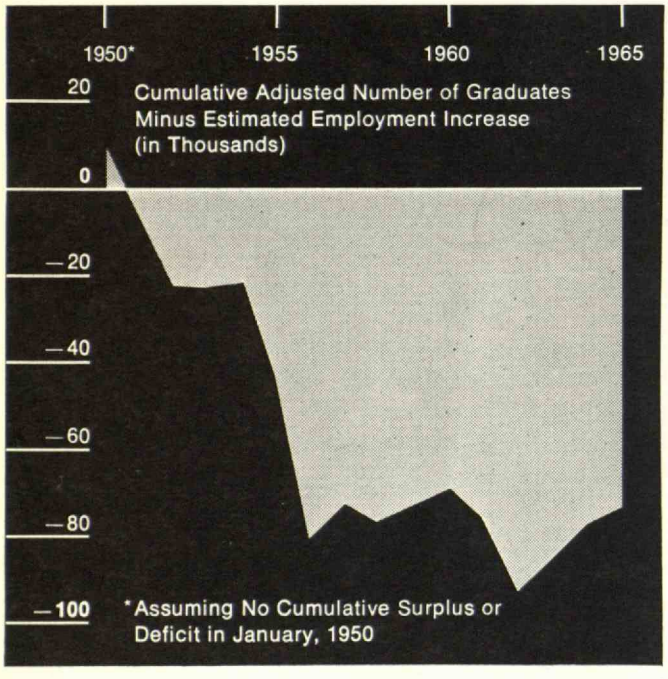


Figure 9. Between 1950 and 1965, nearly 100,000 more engineers were created (on the employment record) than became available as new graduates. This graph traces the cumulative progress of the appearance of "engineers" for whom no engineering degrees were awarded. (Sources: employment figures—National Science Foundation/Bureau of Labor Statistics; degrees—U.S. Office of Education *Digest of Educational Statistics,* OE-10024-70, Washington, 1970 edn.)

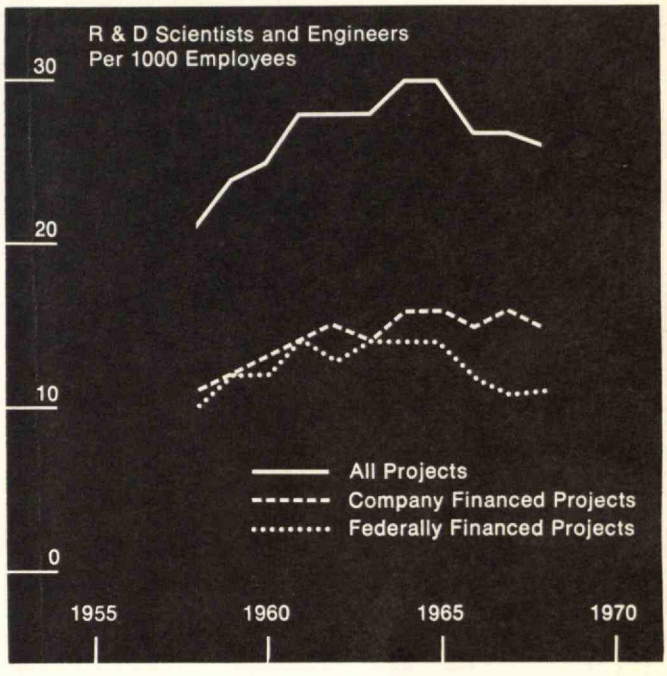
rates of inflation and of improvement in productivity. Indeed, the rapid growth of federal research and development has itself done much to raise the costs. The major increases illustrated in Figure 7 correspond to the increases in federal research and development support (Figure 5). A dominant source of the rise in costs was the increase in salaries of scientists and engineers relative to others (Figure 8).

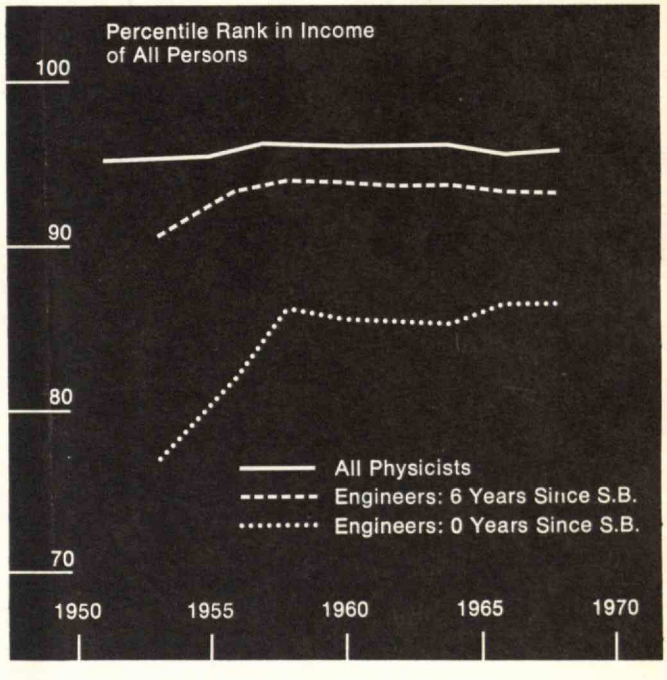
During the period 1950 to 1960, the rapid increase in space and defense research and development increased the demand for new technical people (4). Apparently there was, within industry, a transfer of technical people from industrial to governmental projects. Because of this competition and the great increase in research and development support, salaries rose, and the cost of research and development, and probably of other technological activities, rose significantly.

Figure 9 illustrates a dramatic effect of this extraordinary demand. Between 1950 and 1965, nearly 100,000 more engineers were created than were available as graduates with engineering degrees. During these years, the increase in the number of engineers reported to be employed was substantially greater than the number of new engineers entering the labor force from higher education. Thus, it appears that industry must have been upgrading technicians to take the place of trained people who were transferred to federal programs. A related consequence of the rapid growth of research and development must have been a decrease in the average level of training, if not skill, of the remaining industrial engineers.

Since 1950, there has been an increase in industrial funding for research and development. However, its impact has been limited by rising costs. Figure 10 illustrates the year-by-year change in the number of R. & D. scientists and engineers per 1,000 employees in those companies performing research and development. Even these figures are somewhat inflated, for some of these scientists and engineers were no doubt engaged in research and development related to products sold for defense and space purposes. The figure illustrates that research and development for industrial purposes has remained about constant for nearly ten years.

Figure 10. For those companies reporting research and development activity, these curves show the number of R. & D. scientists and engineers employed per thousand employees. (Sources: 1958-1961—authors' estimates; 1962-1968—National Science Foundation)





Other factors have probably affected the industrial investment in technology. Interest rates have continually risen in the United States during this period, and, according to some economists at least, this has retarded capital investment. Not only is capital investment required in order to infuse new technology into the economy, but also large investment commitments in general tend to stimulate research and development. In addition, it is likely that the combination of high government demand and rapid obsolescence of technology in the space and defense fields attracted a disproportionate fraction of venture capital to these industries, and was an important contributing factor to the rising price of capital.

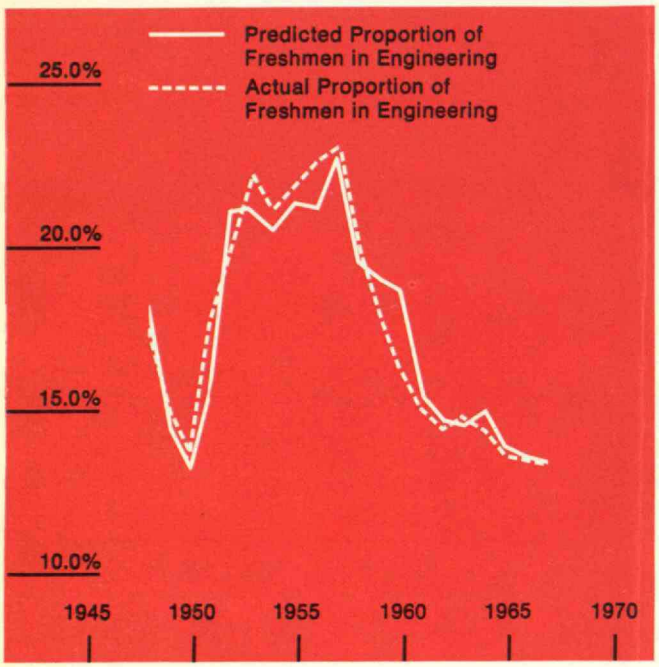
During the last several years, the decline of the federal effort has not been compensated for by the slight increase in industrial activity. The result has been unemployment of scientists and engineers, particularly those that were connected with space and defense. Crude estimates indicate the total unemployed to be of the order of 100,000.

To reiterate, the rapid and large growth of federally supported research and development, occurring particularly between 1953 and 1960, appears to have had several major effects on the technological activity of the United States and its industry. The most important effect of this growth was the rise in overall cost of research and development. This increase occurred not only in the costs of research and development to the government, but, very significantly, in the cost of this activity to industry. A major factor in this cost rise was the increased cost of the technical personnel engaged in it. The rise in the rank of starting engineers and scientists in the income distribution, relative to the rest of the population, dramatically illustrates this increase (Figure 11).

Starting salaries for engineers with bachelor degrees, for example, rose during the period of rapid research and development expansion from the 77th percentile in the rank of income of all people in the United States, to about the 86th percentile. During this same period, it is estimated by Freeman that about 20 to 30 per cent of the increased activity supported by the federal government was made possible by a transfer of people from industrially supported projects. The remaining increase was accomplished by absorbing the supply of new

Figure 11. If incomes of all persons are arranged in a ranking order, any given income can be assigned a percentile position, indicating the percentage of the population having a lower income. Shown here are the percentile positions of median salaries earned by engineers and physicists. (Sources: as Figure 8)

Figure 12. Changes in salary within the engineering profession as a whole affect the number of students choosing engineering majors. This graph shows the success of a prediction of the proportion of all freshmen who choose engineering, made on the basis of engineering salaries, relative to other professional salaries, one year earlier. (Richard B. Freeman, *The Market for College-Trained Manpower,* Cambridge: Harvard University Press, 1971)



	Engineering	Physical Science	Mathematics	EMP Total
1948	17.5	4.8	1.5	23.8
1949	17.2	4.5	1.3	23.0
1950	15.8	4.7	1.5	22.0
1951	14.8	4.4	1.5	20.8
1952	13.4	4.4	1.5	19.3
1953	12.0	4.2	1.6	17.8
1954	11.9	4.4	1.5	17.7
1955	12.3	4.6	1.5	18.3
1956	13.1	4.7	1.6	19.4
1957	14.0	4.7	1.7	20.4
1958	14.5	4.7	2.0	21.2
1959	14.9	4.8	2.6	22.3
1960	14.7	4.9	3.3	22.9
1961	14.0	4.7	3.7	22.3
1962	13.2	4.7	4.0	21.9
1963	12.1	4.6	4.0	20.7
1964	11.7	4.5	4.2	20.4
1965	11.5	4.3	4.0	19.8
1966	11.8	4.5	4.4	20.7

Table I. The combined fraction of male college graduates choosing science, mathematics and engineering has changed little since World War II, although the relative proportions of these fields have changed somewhat. (Hugh Folk, *The Shortage of Scientists and Engineers,* Lexington, Heath Lexington, 1970)

technical people.

University as Supplier

The increase in demand generated by federal funds had a significant effect on the choice made among fields by those attending universities. The fraction of college graduates opting for science, mathematics, and engineering has changed very little since World War II (Table I). Hugh Folk has pointed out that the choice of a broad field by students does not appear to be affected by demand, which influences only the choice of lucrative activities *within* broad fields. Changes in salaries and stipends affect the choices between specialties, and determine in part whether or not students opt for graduate education in special fields. However, though those in science and engineering have been mostly supported by federal funds to universities, the proportion of scientists and engineers among all PhD's has not increased appreciably. Apparently, the federal funds merely permitted the universities to redistribute their resources to a rapidly rising social demand for graduate education proportionately in all fields of knowledge. Changes in salaries and stipends affected choices toward engineering and toward physics, for example. Figure 12 illustrates the relationship between the actual number of freshman enrollments in engineering, year-by-year, and the changed incentives predicted from salary changes.

There has been some shift between engineering and mathematics, but, in any event, the response of the new supply of technical people to economic factors is sluggish and cyclical. The yearly new supply of graduate scientists, mathematicians, and engineers has varied from 33,000 to a high of 61,000. In recent years, this new supply has been about equal to the reported increase in new employment of scientists and engineers, implying little upgrading of people who did not have a "certificate" as scientists or engineers.

There has been great growth in the support of research in universities by the federal government, with by far the largest share derived from the support of biomedical research in university medical schools and affiliated hospitals. However, for the physical sciences, and especially engineering, the largest share has derived from the Defense Department, AEC, and NASA. This support surely biased university activity away from industrially related research, especially that connected with the less glamorous industrial problems.

The Practical Loss

While it is probably impossible to assess all the effects of federal policy over the past several decades, there are several possibilities that appear reasonable. It seems reasonable to expect that, ten years or so after a relative decline in technical activity, its consequences should begin to be evident. For example, the rate of increase in productivity might begin to diminish. Although the dependence of productivity upon a wide range of other factors (the availability of capital, for example) is well recognized, eventually a reduction in investment in technical activity devoted to industrial purposes should be reflected in a decreased rate of im-

Table II. Approximate proportions of national resources, at market prices, devoted to research and development. For the U.S. and European countries selected, the figures are averages for 1959-1965; for Japan, the figures are for 1963. The data appear to indicate a significant U.S. advantage in defense and space research and a rather lesser advantage in civilian-oriented work. (Sources: Japan—*International Statistical Year for Research and Development, A Study of Resources Devoted to R. and D. in O.E.C.D. Member Countries in 1963/64,* Vol. 2, O.E.C.D., Paris, 1968; other countries—Boretsky, ref. 6.)

	Total R. & D. Expenditures as Per Cent of G.N.P. at Market Prices	R. & D. Paid for by Government Funds		R. & D. Expenditures for Defense and Space		R. & D. Exp. for Ind. and Other Civilian Purposes	
		As Per Cent of G.N.P.	Per Cent of Total R. & D.	As Per Cent of G.N.P.	Per Cent of Total R. & D.	As Per Cent of G.N.P.	Per Cent of Total R. & D.
United States	3.3	2.12	64.2	1.92	58.3	1.38	41.7
U. K.	2.2	1.32	60.0	0.85	38.6	1.35	61.4
France	1.5	1.03	68.9	0.62	41.0	0.88	59.0
Germany	1.4	0.62	44.0	0.13	9.0	1.27	91.0
Netherlands	1.8	0.63	35.0	0.09	5.0	1.71	95.0
Belgium	0.8	0.19	24.0	0.03	4.0	0.77	96.0
Norway	0.7	0.41	58.0	0.05	7.0	0.65	93.0
Sweden	1.5	0.74	49.0	0.33	22.0	1.17	78.0
Italy	0.5	0.16	33.0	0.03	6.0	0.47	94.0
Japan	1.4	0.4	28	—	—	1.4	100.0

Table III. The same information as in Table II, for civilian-oriented work only, translated into cost-equivalent terms and into full-time-equivalent technical man power. The last column expresses each national civilian research and development effort (in cost-equivalent terms) as a proportion of that nation's G.N.P., also converted into cost-equivalent terms. A number of nations, on this basis, have been making more intensive research efforts during the early '60's, for civilian purposes, than has the U.S. (after Boretsky)

	Civilian R. & D. Effort U.S.-Cost-Equivalent Expenditures		Civilian R. & D. Effort Employment of Professional Manpower		Comparative Level of G.N.P. in 1964	Ratio of Column 2 and Column 5
	$ Million	Per Cent of U.S.	Full-time-equivalent Number (,000)	Per Cent of U.S.	Dollars of Equal Purchasing Power	
	Column 1	**Column 2**	**Column 3**	**Column 4**	**Column 5**	**Column 6**
United States	7,762	100.0	231.9	100.0	100.0	1.00
United Kingdom	1,994	25.7	102.3	44.1	16.2	1.59
France	967	12.5	54.1	23.3	13.9	.90
West Germany	1,896	24.4	76.0	32.8	17.5	1.39
Italy	333	4.3	22.9	9.9	9.2	.47
Netherlands	436	5.6	26.2	11.3	3.4	1.65
Belgium	185	2.4	10.7	4.6	2.8	.86
Norway	54	0.7	3.3	1.4	1.1	.64
Sweden	289	3.7	14.2	6.1	2.7	1.37
Western Europe, 8 Countries	6,154	79.3	309.7	133.5	66.8	1.19
Japan	1,460	18.8	168.4	72.6	14.9	1.26

provement in productivity. And, indeed, in the last few years, productivity increases have declined (5).

There is another way in which we can deduce the effects of the post-war research and development policies. Boretsky (6) has compared the technical activity of Europe and Japan with that of the United States for the period 1959-65 (just following the rapid growth of the United States effort). Table II compares the total research and development efforts for these years as fractions of national G.N.P.'s at market prices, for the United States, Japan and the major European countries. The defense and space portion of the total effort and the civilian effort are also included for comparison. Superficially at least, this table would indicate a significant advantage of the United States for all research and development, and a somewhat lesser advantage in its "civilian-oriented" activity.

However, when research and development efforts are translated into cost-equivalent terms, and into the number of scientists, engineers, and technicians employed (Table III), the results are startling. The last column in Table III expresses cost-equivalent expenditures for research and development as fractions of the G.N.P.'s, the latter converted to equal-purchasing-power terms. When the comparison is thus made on the basis of cost-equivalent expenditures, the relative advantage of the United States investment in civilian research and development disappears. Even more significant, about 30 to 35 per cent more scientists, engineers, and technicians were engaged in civilian-oriented research and development in the eight European countries studied than in the United States. This group of countries has a slightly greater population than the United States, but a one-third smaller G.N.P. When compared on this basis, the relative effort in Europe was substantially greater than that in the United States—the reason being, basically, that the relative cost of research and development personnel is less in Europe than in the United States.

Furthermore, there was no substantial investment in defense and space research and development in any of the European countries except the United Kingdom; there was not a disproportionate rise in salaries, and there was no marked displacement of scientists and engineers from industrial to national projects. Although European data for more recent years are not readily available, it seems likely that—in view of the slow growth of research activity in the United States relative to other O.E.C.D. countries in these years—the disparity is now even greater. As early as 1955, the number of scientists and engineers engaged in non-space, non-defense activity in Europe must have been higher than in the United States.

A comparison between Japan and the United States is even more depressing. During the 1959-65 period, the Japanese spent a significantly larger portion of their G.N.P., on an equivalency basis, for civilian research and development than did the United States. With one-half the United States population and one-fifth the United States G.N.P., Japan employed 70 per cent as many professional research and development personnel in their civilian effort as did the United States.

Spin-Off?

Many would argue that the analysis thus far has neglected the indirect effects of the space and defense research and development efforts of the United States. It is clear that the research and development that has been supported by the government must have been beneficial to at least some industrial activities. Further, the government provided a market for sophisticated technical goods, which no doubt stimulated research and development activities which were transferable to civilian products. But, granted that this indirect effect of space and defense oriented work presumably exists, the question is, how significant is it?

Boretsky analyzes this matter in what seems to be an effective way. Consider the efforts of ten people engaged in federal research and development; how much effort aimed at a particular industrial objective, on the average, are these ten equivalent to? Boretsky argues that their absolute maximum equivalent is 3-1/3, and the minimum is perhaps one-half a civilian researcher. In other words, 5 to 33 per cent of a given amount of space and defense research and development might be considered to be the "direct" effect of that effort on the economy.

Assuming a "spin-off" as high as 20 per cent (for both Europe and the United States) a new measure of the effective number of scientists and engineers can be derived. It turns out that the United States still lags

behind Europe and Japan on a comparative population basis. In the specific field of nuclear technology not related to military applications, Boretsky makes a more startling comparison. He estimates that 50 per cent more scientists, engineers, and technicians are involved in this work in Europe than in the United States.

This disparity in technical effort, existing for more than ten years, may have begun to be reflected in our trade with Europe and with Japan. Consider the trade balance in the technologically intensive products of chemicals, machinery, electrical equipment, transportation equipment and instruments. In 1968, the United States had a favorable balance of trade of these products with Europe of $1.5 billion. From 1962 to 1968, however, the rate of growth of imports of these products from Europe averaged 20 per cent, and the rate of growth in their export from the United States averaged only 9 per cent. During this same period, the United State's trade balance with Japan in these products turned from a $300 million surplus to a $500 million deficit. While United States imports from Japan were growing at 32 per cent a year, United States exports to Japan were increasing at only 7 per cent a year.

If the trend continues, Boretsky estimates that by 1973, in technologically intensive products alone, there will be a trade deficit with Europe of almost $2 billion. The situation with respect to Japan is even more disturbing: he estimates that the United States "technological" trade deficit to Japan will be almost $5 billion by 1973.

It is clear, of course, that monetary factors and relative labor cost factors are also important to trade balance considerations. It is only in high-technology products with rapid potential for growth (and in agriculture, where the U.S. has long maintained a technological lead) that the United States has had much of a potential advantage—and it is here (*except* in agriculture) that we find the downturn.

Clearly, analysis of a matter as complicated as the relationship between technology, the economy, and social welfare can never be complete, nor can conclusions drawn from incomplete analysis ever be taken with assurance. Nevertheless, it appears that in the United States we have substantially under-invested in the kinds of technical effort that are necessary for the improvement of our industrial output and the quality of our life. In recent years this under-investment in technology for civilian pursuits has been made substantially greater as a result of the large commitment of the United States to activities related to defense and space. The natural working of the economic system which would in any case have led the industry to invest too little in technical activities has been further distorted because of the higher cost of research and development resulting from the federal effort. Even in the government sector of research and development, all the European countries and Japan spend more than 20 per cent of government research and development for civilian purposes, whereas the United States spends less than 6 per cent. Thus our competitors supplement the industrial investment in research and development for civilian purposes to a much greater degree than do we.

The Choice of Strategies

We are now faced with a dilemma. There are 100,000 scientists and engineers out of work; there are large unsatisfied social needs; we are suffering adverse effects from our past uses of technology; and our economic growth is faltering. At the same time, the costs of education and of research and development continue to rise, sustained apparently by the social and political structure that we have set up.

Direct research and development investments by the federal government—whether for defense, space or social welfare purposes—will, if they are too large, draw off technical activity which could be turned to industrial improvement, just as we experienced in the 1950's. Substantial increases in the availability of new scientist and engineer graduates would eventually lower their relative prices, but there would be a period of costly and inhumane readjustment. On the other hand, restrictive policies to discourage young people either from opting for technical education or from continuing at university for advanced graduate education are, of course, in the long term, self-defeating.

Like any complex public problem, this dilemma will not be resolved by any single public policy decision. Addressing the social tasks directly, perhaps the most important single action that is required is a substantial

increase in support for the improvement, both in quality and efficiency, of those public services in which private industry plays only a small role, such as education and the delivery of health care. Likewise, those socially desirable activities in which private incentives for technical work are small or non-existent, such as the improvement of living conditions in the cities and of the safety of our transport system, require significantly increased support.

To simply spend enough to re-employ unemployed scientists and engineers by immediate federal research and development funding in these social fields, is not the answer, for we do not know enough about the task; nor would such a move (which would in any case face great social obstacles) encourage industry to play its own part. For the present, in these fields we must not only invest in research and development, but we must devise ways of changing the structure of the delivery systems of social services and of the education of technical people, to facilitate the adoption and diffusion of new techniques. A major effort of direct government support to meet these social needs is required.

A second major effort would be the encouragement of university research related to improving industrial productivity, to reducing the waste and pollution of industry, and generally to problems associated with the productivity, products, and adverse effects of industrial production. This federal support to universities would redress the present academic bias, especially in engineering, toward the kinds of work that tend to improve our defense and space capabilities.

In some way, also, government must underwrite industrial research and development itself, since the economy has always tended to under-invest in it, and its present over-costliness results from past federal policies. This can be done either directly by subsidy or indirectly through tax rebates. The entire set of corporate and government policies that encourage potentially high-export industries needs to be reviewed.

Whether a society effectively uses technology for productive and beneficial purposes depends upon a large number of factors. The supply of technically trained people, the willingness to invest in them, the capital necessary to embody the technology in useful machines and processes, the level of general education, the skill of the potential labor force, the economic and political structure of the society, all play roles. The effective use of technology requires that a large number of appropriate conditions be met simultaneously; a single missing ingredient (for example, the absence of available capital, or the necessary management attitudes) may completely halt either technological innovation or the spread of technology within the society.

If we are to meet the social needs of our time and to continue to provide the material needs of our population, new policies and directions of our governmental, industrial and academic institutions are required.

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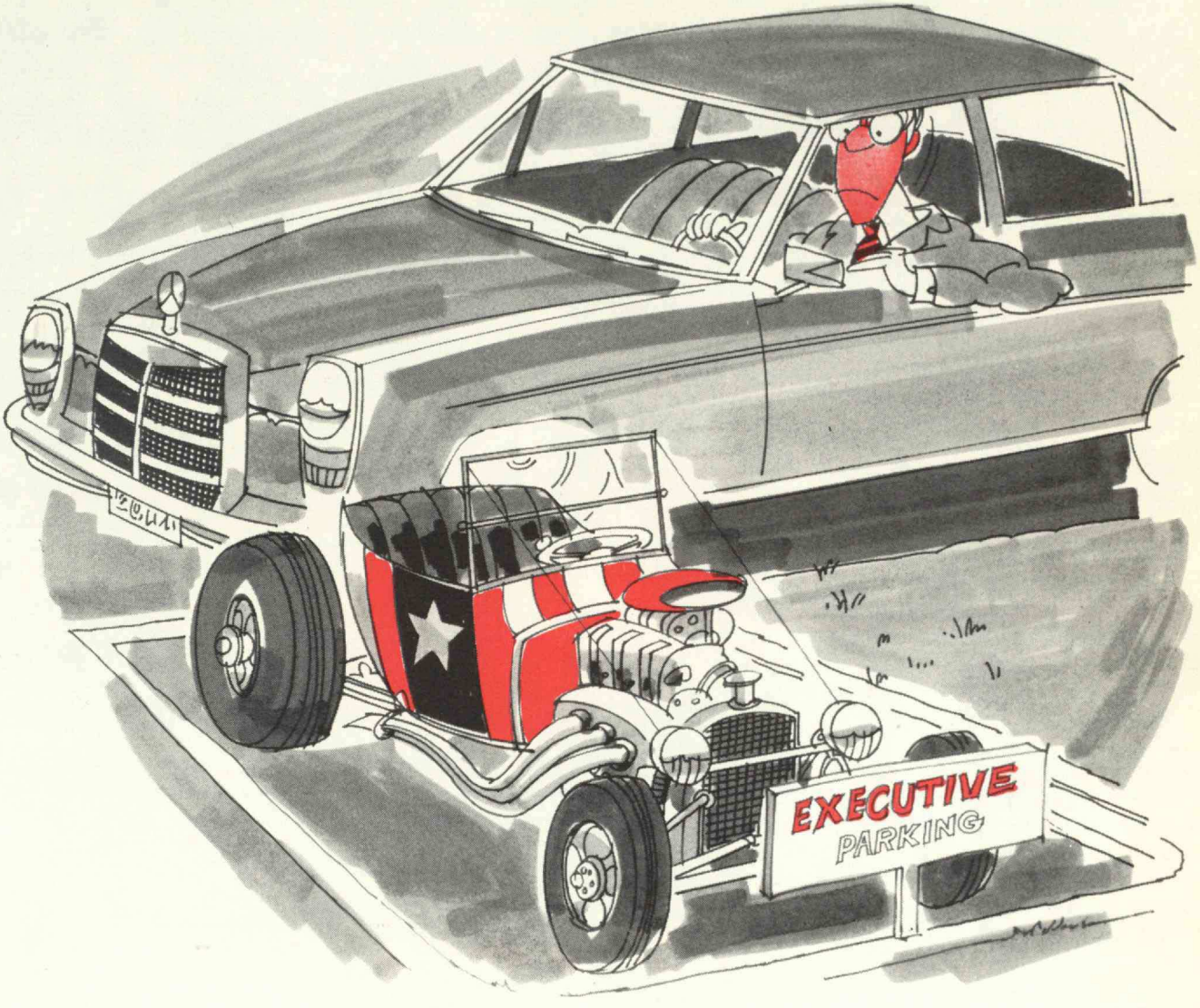
J. Herbert Hollomon, currently serving as Consultant to the President and the Provost of M.I.T., was formerly President of the University of Oklahoma. Under President Kennedy he served as Assistant Secretary of Commerce for Science and Technology, and as Acting Undersecretary of Commerce under President Johnson, Dr. Hollomon is a graduate of M.I.T. (his doctorate is in metallurgy). He founded *Acta Metallurgica,* and co-authored, with L. Jaffee, *Ferrous Metallurgical Design.* He is a founding member of National Academy of Engineering, and is presently on the N.A.E.'s Committee for Transportation.

Alan E Harger, Administrative Assistant to Dr. Hollomon, was formerly Assistant to the Director of the Division of Sponsored Research at M.I.T. He is an M.I.T. chemistry graduate whose Route-128 industrial experience includes consultancy work for the High Voltage Engineering Corporation.

It's hard to get fired up about spontaneous combustion when the stock boy parks you-know-where.



Oh boy, you can hear the reaction now, when Mercedes meets beach buggy! Meantime, out back another kind of reaction is coming to a head. Careless storage of waste material that's going to burst into flame. A detail that should have been covered, but wasn't. An Arkwright-Boston man can show you how to protect your plant against combustion and other risks, big and small.

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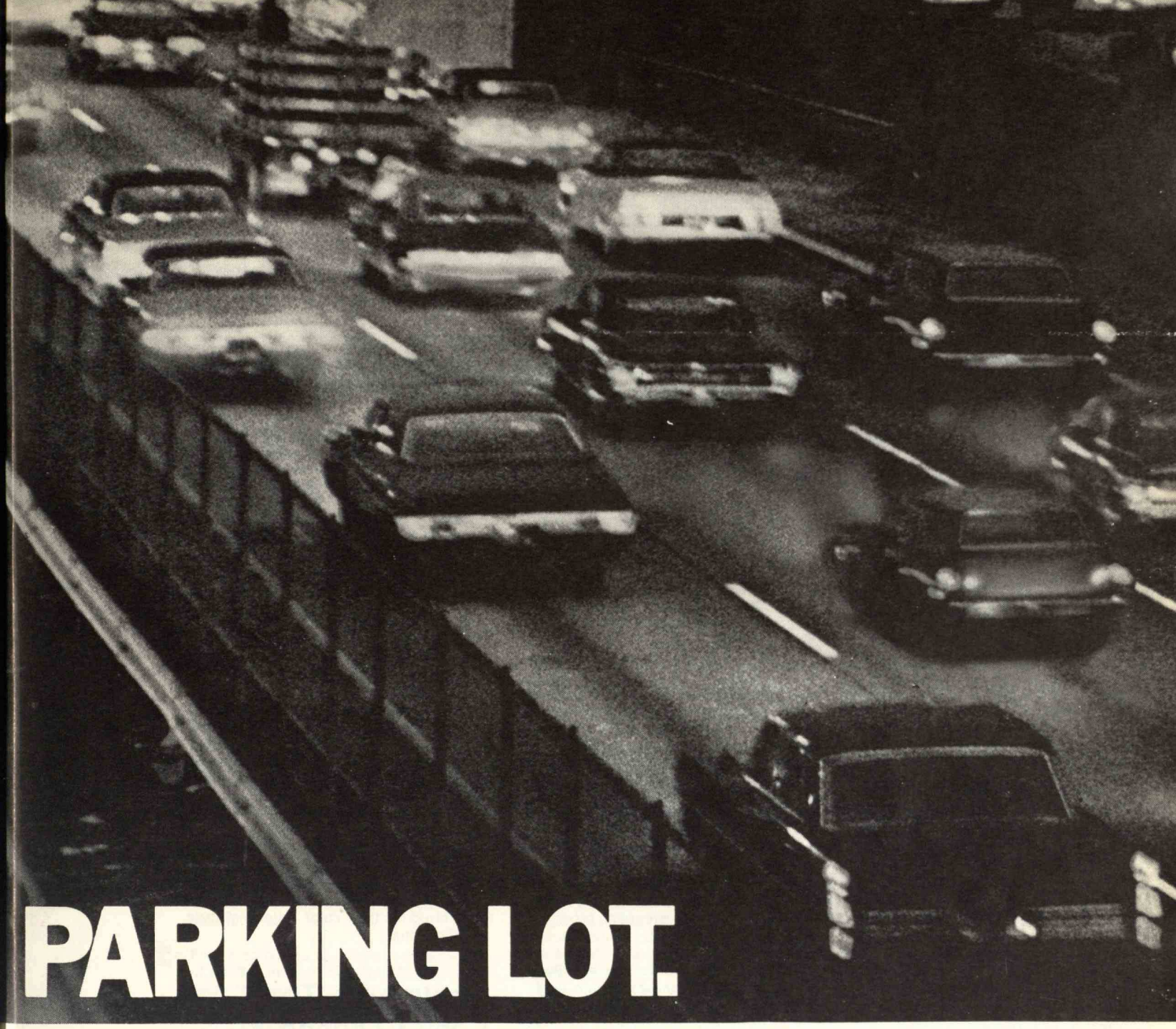
Soon 90-mph commuter trains will put a little more rush back in everybody's rush hour. And nickel's helping make it happen.

At last, true high-speed rail service is on the way. In mass transportation systems from New York to San Francisco.

And, by taking some of the pressure off our clogged highways, it promises to make life easier for motorists as well as rail passengers.

The progress of the Long Island Railroad is typical. Every week now, it replaces six or eight of its old cars with gleaming "Metropolitan" cars. About the middle of next year, after its entire new fleet of 620 cars has been put in service, it will start cutting commuting times throughout its system.

Both the frame and skin of the new Metropolitans are nickel stainless steel. The nickel's in there for several reasons. It makes the steel easier to weld and form, and adds toughness to insure car safety. It also helps arm the car against grime and corrosion. Maintenance can take place at the wash siding, instead of the paint shop.



PARKING LOT.

And, because of the remarkable strength-to-weight ratio of nickel stainless, each new car is about 3,000 pounds *lighter* than if it had been built with ordinary steel. Which means quicker acceleration and braking, plus savings in power costs estimated at $2,700,000 for the fleet over a 35-year lifespan.

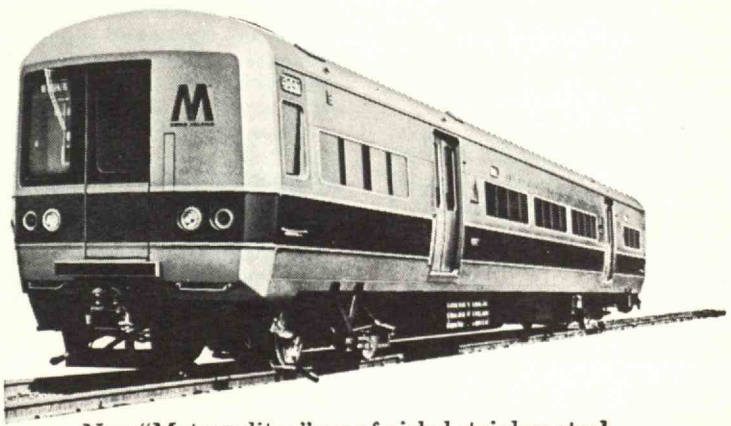
Just as our metal is a helper, one that improves the performance of other metals, so International Nickel is a helper.

We assist dozens of different industries all over the world in the use of metals. We offer technical information. And the benefit of our experience. Often, Inco metallurgists are actually able to anticipate alloys that will be needed in the future, and to set about creating them.

This kind of helpfulness, we figure, will encourage our customers to keep coming back to us.

And that helps all around.

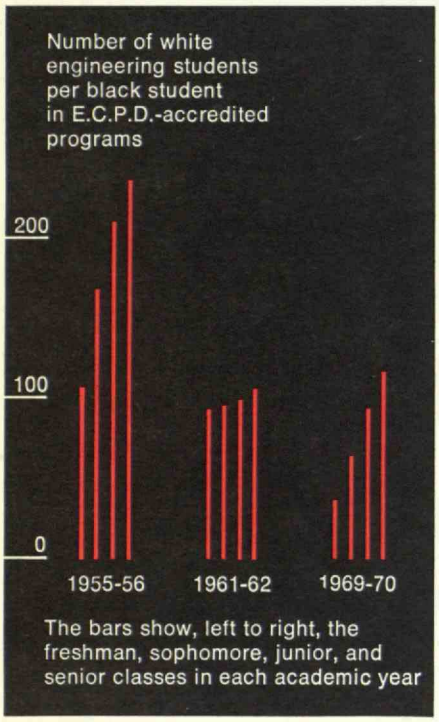
The International Nickel Company, Inc., New York, N.Y. The International Nickel Company of Canada, Limited, Toronto. International Nickel Limited, London, England.



New "Metropolitan" car of nickel stainless steel.

INTERNATIONAL NICKEL HELPS

Trend of Affairs



Can blacks take a greater role in the engineering profession? Perhaps—but not soon. Only since 1968 have blacks accounted for more than one in 100 students enrolled in engineering curricula accredited by the Engineers' Council for Professional Development, and in some classes the proportion has been fewer than one in 200. (Data: Foundation for Advancement of Graduate Study in Engineering)

CHANGING ROLES

The Black Engineer: Opportunity and Frustration

The law of supply and demand is now highly favorable to blacks in the field of engineering. Employers are competing hard for the available black engineering talent; blacks are receiving more job offers than whites and current starting salaries for black engineers are higher than for whites.

But there is no evidence that blacks are turning to the engineering profession as a means of upward social and economic mobility.

Indeed, according to Robert Kiehl of the Foundation for the Advancement of Graduate Study in Engineering—a project of Newark College of Engineering—there has been with one exception no increase in the number of blacks in engineering curricula during the past seven years. The exception is in the current freshman and sophomore classes, the result of special programs for minority students.

A very complex set of factors effective at every stage of advancement into engineering have historically siphoned blacks away from engineering and technical studies, according to Dr. Kiehl. Among them: The preparation of black students in mathematics and science at the secondary level tends to be poor. Neither the community nor their schools give black students an idea of the possibilities and rewards of engineering or technical professions; the exposure of young blacks is toward those professionals most visible in their communities, mostly teachers.

Of those who do enter engineering curricula at colleges and universities—blacks presently account for two per cent of all engineering students in the U.S.—their staying power through the four year curriculum is not strong. Financial problems and inadequate preparation for engineering studies seem to contribute most to the drop-out or transfer rates.

A survey of blacks now employed as engineers, included in Dr. Kiehl's study for the Manpower Administration of the Labor Department, suggests that though blacks may find their first jobs easy enough to get, professional advancement presents difficulties. A good majority of those surveyed by Dr. Kiehl said they were basically satisfied with their jobs, but there was much discontent over promotion policies. Many blacks reported that promotions were hard to come by; they cited "lateral movements with increased salaries instead of vertical promotions with increased salary and responsibility"—and said that advancement into management is virtually nonexistent. Though the black engineer may receive a higher starting salary than his white colleague, he is likely to lose this advantage because of his narrower opportunities.

Dr. Kiehl concludes that there is a good deal of "showcasing"—hiring of blacks to meet quotas or for public relations purposes. The result is that many blacks in engineering suspect that they have been hired for their color instead of their qualifications.

Ecology In Ten Easy Lessons

Representative Louis Frey (R.—Fla.) has initiated, in his state, a retraining program for unemployed engineers. The program is known as RETRO—Regional Environmental Training and Research Organization. But the problem may not be so simple or so simply solved.

William Osinsky (laid-off aero engineer turned journalist) writes:

Compared to the job-shopping in the concentrated aerospace employment centers of the past decade, developing technical positions in the far-flung government environmental agencies will certainly be harder. But Rep. Frey

feels that the effort may help to prevent massive layoffs in the future.

The men: guidelines have been set up for the acceptance of prospective students. Successful applicants must either have been employed in the aerospace industry for 12 of the past 24 months or be able to demonstrate an "attachment" to the aerospace field. Any applicant who has refused "suitable" employment would be ineligible.

Students would be granted a stipend while enrolled and would be granted up to $1,000 toward moving expenses where a relocation would be required to obtain employment.

The money: The RETRO program is funded jointly by the Department of Labor (D.L.) and the Office of Education (H.E.W.), each organization contributing $250,000. The H.E.W. funds will cover costs of the actual training, and D.L. will meet the living allowances of the students. These initial monies will provide for an enrollment of 120 students in the first, pilot-program level of RETRO. D.L. will pay for two placement counselors to be attached full-time to the program, and for the travel and moving expenses of the students.

Frey also hopes to obtain a small slice of the $42 million President Nixon has set aside for manpower redevelopment.

The program: Three schools in the spaceport area will participate in the program, which was scheduled (at this writing) to start in June. Courses for environmental technicians and a supplemental program at the undergraduate level for environmental engineers will be held at Brevard Community College and the Florida Institute of Technology, respectively. At Florida Technological University (F.T.U.) near Orlando, the course offerings will lead to an M.S. degree in Environmental Systems Management.

According to David L. Block, Assistant Dean of the F.T.U. School of Engineering, the concept there is to attract "people with specialized experience in large systems." After a term of review courses, the student will spend about two terms on a core program which will include courses on practically every current phase of environmental engineering. In his final term the student will be allowed to select an area of specialized study, which is expected to relate to his aerospace experience.

No one can deny that there are a lot of engineers in this country who need work. But Frey's proposed solution seems exceedingly distasteful to the engineers at whom it is aimed, in several respects.

RETRO, instead of weaning engineers from dependence on the federal "mother cow," appears to be a bureaucratic maneuver roughly akin to switching teats. And most of the promised jobs will doubtless be with governmental agencies, this time with sewers the target instead of the moon.

Furthermore, these programs carry an undercurrent of disregard, even contempt, for the individual engineer. One of the most brutal aspects of being laid off is the haunting feeling that, along with his technical specialty, the engineer himself has been arbitrarily rendered obsolete. RETRO confirms this suspicion. And, in saying that no one who has refused "suitable" employment is eligible for the program, RETRO is literally assuming veto powers over its applicants' choice of careers.

The men whom this program is trying to "train" have been making sophisticated technical decisions for years, and in some cases for decades. To reduce these men to a subsistence-level stipend and make them go to school before they can work is to say that their experience is practically worthless.

Finally, there is the insulting purpose of these programs, expressible as "putting all those aerospace engineers to work on the environment." The implication is clear: that bureaucrats know better than the professional engineer how the engineer should be spending his life. An alternative view is that if engineers had had as much to say as politicians in planning this century's "progress," the environment might not be in such bad shape.

URBAN

The Ultimate Housing Problem

The shortage of acceptable housing for people of average and below-average income is well enough known. Not quite so well known is the fact that hundreds of thousands of potential homes—or at any rate, recent homes—stand empty. Those aerospace engineers who are beginning to enquire into the possibilities for "urban technology" may be interested in a study released this spring by the National Urban League and the Center for Community Change; an authors' summary of which appears in *The Architectural Forum* (April, 1971, pp. 42-45).

The aim of the study was to investigate the extent and causes of abandonment of housing. Seven cities were examined: Atlanta, Ga.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Hoboken, N.J.; New York, N.Y.; and St. Louis, Mo. Of these, Atlanta and Detroit acted somewhat as controls, since abandonment is not a problem in the former and is not widespread in the latter.

"Atlanta," the researchers write, "substantiates our hypothesis that housing abandonment is related to the formation of a crisis ghetto." A crisis ghetto is defined as one "in which poverty and social pathologies have become worse since 1960 both in absolute terms and in comparison with the rest of the city." The Atlanta Negro area, in contrast, houses people with a range of incomes, and "remains socially and economically viable."

Of Detroit, the study says: "The existence of a black middle class tied to home ownership in the central city, together with the continuing willingness of local financial institutions to grant conventional mortgages in black and transition areas, are, we believe, the principal reasons for the absence of a major abandonment problem."

Although the best-known case of massive abandonment is Brownsville, New York

City, the study picks St. Louis as "farther along toward abandonment than any other central city in the country." (New York is an exceptional case—the only major American city with rent control, which the landlords claim as a powerful factor in their decisions to abandon property as valueless.) In St. Louis, "mortgage lenders freely admit having cut off all funds for the entire city with the exception of one all-white neighborhood. This 'red-lining' extends to those suburbs where middle-income Negroes have gained entry."

The study identified six main stages along the primrose way to what city fire departments recognise as the everlasting bonfire. First, a decline in an area's "socio-economic status" as middle-class white people leave; second, an inflow of nonwhites. Third, speculation in property, including the technique of "blockbusting" which preys upon fears of falling property values. Fourth, "weakened market conditions, and emergence of a crisis ghetto". Fifth, the withdrawal of capital investment from the area. Sixth, abandonment proper.

The penultimate step, known to economists as disinvestment, is critical "whether caused by owners who pocket maintenance and improvement money or by financial institutions who 'red line' a neighborhood," the researchers find. "If, at this juncture, inflated values can be deflated and investment capital found, abandonment probably need not follow."

In New York City as a whole, disinvestment is proceeding in at least seven per cent of the housing, whereas only 2 per cent is actually abandoned as yet. This disinvestment, say the authors of the study, "will probably lead to final abandonment, without drastic intervention." They believe that there may be a "tipping point" phenomenon: when 3 to 6 per cent of a neighborhood is abandoned, "investment psychology probably becomes so severely depressed" that the process becomes irreversible by normal economic means. (The New York Master Plan says of Brownsville's recent history: "Panic spread. Tenements emptied out as though hit by plague. Landlords simply walked away. . .")

Housing codes do not help very much, say the researchers, because "by the time code violations become really serious, the neglectful landlord has typically sold his building to someone without the resources for extensive repairs." At that stage, the only people who will choose to live in such a building are those who cannot pay enough rent to cover the costs of running it. (A recent report by the New York Housing and Development Administration and the New York City Rand Institute showed that present efforts to enforce the Housing Maintenance Code in that city were almost completely ineffectual—almost a million complaints come in per year, but the number of convictions is about 3 per cent of that, with fines averaging $12.62 per convicted landlord.)

"Solutions to abandonment must recognise the many-sided nature of the problem—social, political and economic," say the authors of the *Architectural Forum* paper.

Impoverished Design for Paper-Pushers

Every city has more and more people in the so-called service professions—financing, organizing, designing, advertising, and administering. They spend their time "manipulating paper and messages"; they generate "immense amounts of office work and not much else," a consistent demand for more space and better rugs and a better view, an "office building" architectural convention, and eventually a repetitive, culturally impoverished design for our central cities.

Do we realize the price we pay for the presumed convenience—and excitement—of working near our competitors? Probably not, writes Lawrence B. Anderson, who retires as Dean of the M.I.T. School of Architecture and Planning this summer. High-rise buildings are intrinsically costly; indeed, he writes in the spring issue of the Department of Architecture's periodical *ReseARCH*, the modern skyscraper is a "recalcitrant building type," an "intractable architectural problem," simply because of the economies to be realized by standardization.

"The basic range of possibilities for high-rise buildings seems to have become exhausted, limited as it is by implacable disciplines such as keeping the elevators working in vertical shafts," he writes. "But perhaps beauty is to be found in relations among skyscrapers; composing with massed high-rise structures offers a slender hope."

Slender, because, Dean Anderson notes, the concept implies ever-larger projects, so that "whole districts" can be designed as consistent wholes. And so far "our performance on very large projects has brought . . . few wholly admirable realizations."

Right Action as Beauty

In a city of hate, can art play the role of savior? The answer to this question—posed by John E. Burchard, Dean Emeritus of M.I.T.'s School of Humanities at "Art In Civic Scale", a one-day symposium in honor of Lawrence B. Anderson, retiring Dean of M.I.T.'s School of Architecture—may very much depend on your definition of "art" and "artists."

Addressing herself to the influence "artists" and their work can have, particularly on the urban environment, Elma Lewis, Director of the Elma Lewis School of Fine Arts in Boston, defined the "artist" as a creative person in the broadest sense, thus including engineers, scientists, and technologists and their work and inventions.

"I feel," she said, "that everyone who sits in this institution, which is not generally thought to be connected to art, is an artist, because the man who created the principle of the microphone or the electric light was a very creative individual. And there is a great responsibility to use that art to improve the lot of mankind. Therefore, if he finds himself putting up taller and taller buildings in less and less space and of less and less quality, he is an oppressor. If he finds himself soothing the minds of those who should be titillated with pretty things, he is an oppressor, because the responsibility of artists is not beauty but right action.

"I wonder how we got to the place where we were not to make statements with our art, where art is to sooth, to make comfortable. It isn't. Art is to make uncomfortable and to move to action.

"I am making a statement of only one woman's direction, but I am frightened by the fact that we sit and fiddle while Rome burns. I am constantly listening to people tell me we don't have much longer on this planet. So when we construct more structures on the planet that serve no purpose, when we use the structures that are on the planet to further pollute the planet, I am a little bit worried. When we pack more people in less space, I'm a little bit worried. I wonder then what is the value of our art.

"If I could I would sit with artists and encourage them to address their wonderful talents to solving some of the problems with which we find ourselves. When I see the junk in the streets of Boston, I wonder why someone cannot address his creativity to cleaning those streets in an imaginative way."

With an eye particularly to her immediate audience, Miss Lewis wondered aloud how many were committed to art in this sense. Citing primitive rural living conditions and the oppressive life of many urban residents, she urged that the art community—all people who create—"which lets these kinds of things happen" address itself more firmly to finding a cure for man's inadequacies through the medium of art, an art unconcerned about elegance or frivolous esthetics.

Number 3792's Schooldays

An example of space spin-off in the service of humanity is reported by *Aviation Week* (24 May, 1971, p. 19). It is a system which "frees teachers of the tedium of calling the roll and recording tardy and absent students."

Instead of making old-fashioned pencil marks in a book, the teacher has a keyboard (zero to nine, plus buttons for lateness and a few other purposes). Each child has a four-digit serial number. The keyboards in all the classrooms are connected to a central office with a computer (adapted from a machine used in the Mariner interplanetary missions) which "provides instant readouts of class attendance for each period."

Installed at the John F. Kennedy High School, Sacramento, Calif., the system cost about $100,000. According to Laurence F. Gilchrist of N.A.S.A., commercial production could halve the price.

To aid in the suppression of riots the school has another N.A.S.A. system, costing only $10,000 (and again Mr. Gilchrist envisages a commercial halving of the cost). Each teacher carries a device which emits an ultrasonic bleep. A "network of microphones, amplifiers and relays" carries the news to the office of the principal, who can see at a glance where the trouble is. During one school year the alarm system has been used, on an average, three times a week, and has helped to stop some "potential major disorders."

Computers without Defects?

The manufacturer of minicomputers, says Neal F. Young 2d, has a responsibility which is "new and unique within the whole of the computer industry." Today's mini is commonly used as an "intelligence element" within a routinely operational industrial system of which it forms only a relatively inexpensive detail. So the user "absolutely has a right," says Mr. Young, "to demand zero defects."

Mr. Young is manager of manufacturing engineering in the three-year-old Anaheim, Calif., firm of General Automation, Inc., which sells about 40 of its smallest computers (with a $3600 central processor) per month. At the International Convention of the Institute of Electrical and Electronic Engineers, held in New York City this spring, he told how the zero-defects goal could be achieved. He described a testing process similar to what is called in Europe instrument-evaluation—the computer is made to go through its paces in conditions which systematically simulate the working environment.

Assuming that a machine is well designed, the defects that appear when it is used will depend upon the vulnerability of specific components and assemblies to specific disturbances. Mr. Young listed 43 possible defects, categorized according to the kind of disturbance that shows them up. The basic disturbances are: high and low voltages (a.c. and d.c.); a.c. voltage "spikes"; mechanical vibration; high and low temperatures; and rapid temperature change. On the basis of the conditions that the computer can be expected to encounter during its working life, values are assigned to these parameters (for example, temperature may be anything from 0 to 50°C.) and a series of simulation tests is designed.

There is a general "system test," which checks all computer instructions, all memory locations and all input/output functions against expected voltage variations. And there are three simulation tests—vibration, thermal cycle, and a.c. voltage transients—in which the computer must execute a special diagnostic program. These are followed by a repeat of the system test.

It is claimed that about 1 per cent of the machines fail in subsequent working life (average age of these computers to date is about 10,500 hours). "For the user, it's a beginning," says Mr. Young.

Used Computers: A Growing Market

The used computer now represents the largest single class of capital equipment in the world measured in dollar value—surpassing even jet aircraft and machine tools.

The Boston Computer Group, Inc., says that at least $10 billion of used computer equipment is in the hands of end-users (including the U.S. government) and leasing companies (other than those operated by manufacturers). This equipment, headed for a potentially lucrative used computer market, will be in competition with newly manufactured models. The firm believes that an orderly market for the movement of this $10 billion worth of used computers will develop during the next five years or so.

The resale prices of used computers are already playing an important role in the monthly rentals established by leasing companies, because the current market price of this equipment is substantially below the book values of the equipment in the hands of independent lessors.

In addition to the "general purpose" nature of computers—a strong contributing factor to their resalability—the firm bases their projection of a growing used market on the sale and use life of new computer products (including maintenance) in conjunction with physical mobility.

In their study, "All About Used Computers," The B.C.G. presents in-depth information on how to buy and sell the used computer as well as an analysis of the projected price levels of computers by vendor, equipment model, size and estimated future demand. Their analysis of the state of existing first- to third-generation equipment reveals that:

◇ First-generation computers (vacuum-tube types) are still doing their original jobs and so are of continuing value to their users. But because of "severe technological obsolescence," such computers are really of no use to anyone else. However, they have never been a factor in the used market, even as curios.

◇ Second-generation computers—mostly models installed from 1960 to 1964, such as the I.B.M. 1400's, 1620's and 7000's are "an exceedingly interesting" class. They represent the largest currently available inventory for trading and they share software with many current (third-generation) machines. Customers include users who have tried the third-generation machines only to find that their higher speeds are not in fact worth their higher cost.

◇ Third-generation equipment will unquestionably be the backbone of the future used market; it represents the current bulk of the installed computer population. With it come the sales opportunities represented by substantial peripheral equipment, including remote terminals.

Showing the courage of his convictions, A. F. Monosson, President of the Boston-based American Used Computer Corp., used this unconventional method of touting the merits of used computers on the Atlantic City Boardwalk during the 1970 Spring Joint Computer Conference. His unorthodox approach "got me thrown off the floor of the convention," says Mr. Monosson.

Aids to Evolution

Human interference with the genetic structure of organisms, to make them work for human ends, is already out of the realm of science fiction, and is a matter of routine research for scientists all over the world. This became evident at a symposium on "The Use of Radiation and Radioisotopes for Genetic Improvement of Industrial Microorganisms" held at Vienna in April this year. Sponsored by the International Atomic Energy Agency (I.A.E.A.), the symposium gathered some 100 participants of 27 countries and six international or regional organizations in Austria's capital.

The aim of such work is to improve, by random variation and careful selection, the properties and performances of microorganisms used in industrial processes (fermentation) or in medicine (antibiotics). Attention was focused on mutations, both spontaneous and induced—their origin, nature and results, and new methods to influence these mutations by selecting the proper mutagenic agent. The pure geneticist is mainly interested in mutants with biochemical deficiencies, whereas the industrial mycologist is predominantly searching for mutants which have acquired biochemical properties promising bigger economic returns. Techniques chosen depend upon the respective aims.

In accordance with the title of the symposium, use of radiation and radioisotopes took up a fair amount of the discussion, but there was no doubt that other mutagenic agents, such as chemicals or ultraviolet light, are going to be used in future as well. Some speakers even limited the application of ionizing radiation to cases where its ability to penetrate deeply into biological material is an advantage. Where the organism allows ultraviolet light or chemicals to penetrate to its DNA, these agents will continue to be preferred, due to the fact that sources of ionizing radiation are still rather exceptional in most laboratories and require elaborate shielding to protect the investigator. It was also said that too little is yet known about the mutagenic effects of ionizing radiation on microorganisms, and about the mechanisms involved. Possibly the symposium will give new impetus to research in this area.

Techniques that allow the microbial geneticist to recombine properties of various mutants in one organism seemed to elicit particular interest. In these techniques, cells of two strains, each having some part of the desired genotype, are mixed under conditions where DNA is transferred from one cell to the other, and the desired recombinant is then isolated.

Artificial mutants show alterations not only in biochemical, but also in morphological properties. Reference was made in particular to a mutant which was isolated after treatment of wild-type *Escheria coli*. It regularly produces, during its growth and division, small cells having no nuclei. These "minicells" are metabolically active and persist for long periods, but will not reproduce. They might make very interesting antigens. Morphological mutants have also been used to build up giant cells, some 500 to 1,000 times the volume of a wild-type cell. These large structures too are unable to reproduce. They will grow for several hours, but finally halt their processes of macro-molecular synthesis, stop growing, and frequently break down.

Among other things, the new mutants might be employed for the removal of other microorganisms, a very important task in relation to waste treatment. Equally important is the development of microorganisms which can help in the disposal of oil or plastic waste, but very little was said about these problems at the I.A.E.A. symposium. Another question that was left out of the discussion was any possible danger to man and society from large-scale interference with genetic developments.—*Fred Margulies*

Speaking With Dolphins

Interest in man/dolphin communication peaked once again when the Navy acknowledged earlier this year they had been using black dolphins for a classified surveillance and detection mission in Vietnam.

Man/dolphin communication and cooperation is a recurring theme in maritime folklore and in contemporary literature. The theme of the dolphins' concern and affection for man pervades, and anthropomorphism abounds (e.g., Ashley Montagu, *The Dolphin in History,* 1963). In contemporary science, however, the investigators disagree widely, acknowledging only that several factors—for example, the size of his brain (approximately the same as a human's), his acoustic ranging capabilities, his documented intra- and inter-species social behavior and his language—make the dolphin an interesting mammal to study.

Attitudes range from: "Finally the human species has an opportunity to commit itself to collaborative efforts with another species of high caliber in programs of mutual interest. Though the dolphins are different (even alien), they are quite as flexible, educable, and as intelligent as we are." (John C. Lilly, *The Mind of the Dolphin,* 1967) to "From a systems designer's viewpoint, the dolphin can be considered a self-propelled underwater vehicle, equipped with sophisticated sensory apparatus, and an on-board computer control system that is capable of complex, adaptive, multi-mission programming . . ." (Fitzgerald Laboratories, (1969).

In *The Day of the Dolphin*—technically science fiction, but as much cloak-and-dagger—Robert Merle describes the training of a pair of dolphins to "human-speak," first words, then sentences. (Merle often extrapolates freely from Lilly's work on the details of their training.) After they learn to speak, the dolphins are taken from their teachers and used in a cold-war ploy—with predictable consequences: they refuse to deal further with humans.

It is a good yarn, whose plausible descriptions of defense-oriented dolphin research have led some dolphinologists to speculate as to the role it might have played in the Navy's classifying more of the USN-supported dolphin research after the book appeared (in French in 1967; in English two years later) than had been the case in the early sixties.

In what remains available, one can find different approaches to man's attempts to communicate with another species. Lilly has tried, with some success (see *Man and Dolphin,* 1961; *The Mind of the Dolphin*), to induce his captive dolphins (*Tursiops truncatus*) to learn to communicate with humans by mimicking humans —that is, by using humanoid sounds. Although parts of the dolphin tapes he recorded during his training sessions were understandable, signal-to-noise ratio was low, and understanding was complicated by the difference in human dolphin pitch ranges (human: 125 to 225 pulses/second, with formant frequencies 300 to 3,900 Hz; dolphin: 300 to 1,000 pulses/second, with formant frequencies 1,200 to 24,000 Hz).

Among other things, however, these experiments have convinced Lilly that the dolphins are "eminently trainable in the vocalization and acoustic spheres." But the next, much longer, step is to demonstrate that dolphins can meaningfully use these humanoid sounds as we use language and speech—to communicate.

The late Dr. Dwight Wayne Batteau and his colleagues at Listening, Inc., Arlington, Mass., have used a different approach. Because they believe man should try to communicate the dolphin's way, they have evolved a whistling and clicking language of over 40 words by mimicking the dolphins. (This was not a language by strict definition: it was a series of arbitrary noises assigned to arbitrary nouns and commands.) Working with dolphins (*T. truncatus*) that they had trained with their own operant techniques and using their electronic Man-to-Dolphin Translator™ and Dolphin-to-Man Translator™ (needed because the dolphins would often repeat commands), they have communicated in a limited but successful fashion with these mammals.

The electronic translators were the tools with which Listening, Inc. constructed their man/dolphin language. The MDT detected the characteristic qualities of

the words a man spoke and, in real time, translated them into whistled words. The DMT, after it recognized the pitch variations in the whistled words, produced a synthetic humanoid word which sounded quite like that word as a man might have spoken it. (Since 1969, Listening has been concentrating on projects other than man/dolphin communication.)

In training dolphins to perform routine tasks, even complex ones, the problems of dolphin/man vocalized communication do not arise. The DONAR® system of Fitzgerald Laboratories, Annapolis, Md., achieves programmed learning by using "operant conditioning." First the trainer analyzes what he wants the dolphin (again, *T. truncatus*) to do. He then reduces the results of this analysis to an operational network of simple steps.

While he is training the dolphin, the trainer initiates each of these steps with a well-defined voice-gesture command. When the dolphin successfully completes each step, the trainer rewards him—usually with fish. Finally, after the dolphin has learned the behavior from first to final step, the trainer replaces the voice-gesture command with a sonar pulse code and reduces the feeding reinforcement. The trainer begins work with the dolphin in a training compound, then moves to open water under whatever conditions the dolphin will be working. Though this is indeed a form of man/dolphin communication, it is a less sophisticated kind in that it does not require the dolphin to vocalize.—*Lucy Sloan*

ASTRONOMY

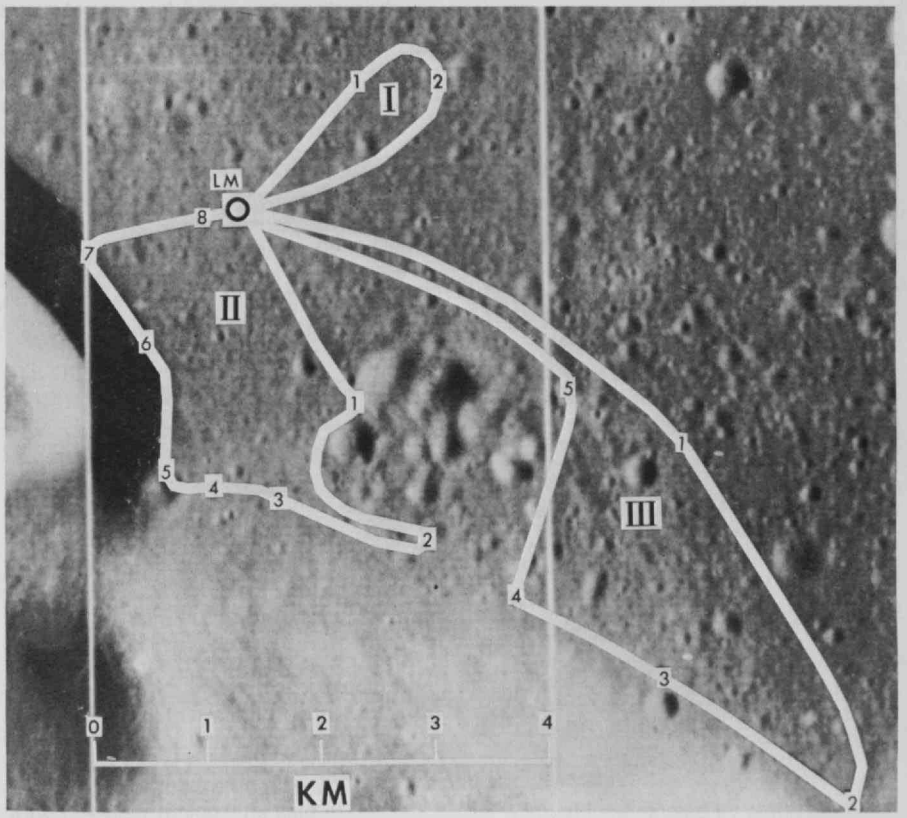
Midsummer Suspense

Apollo 15, scheduled for launch on July 26, may go a long way to turn lunar theory into lunar history; it will be "the most spectacular example of physics in action ever devised by man," said Astronaut Joseph P. Allen at the spring meeting of the American Physical Society.

Apollo 15 will lift off from Cape Kennedy with a payload of scientific gear twice as heavy as any previous Apollo. Its astronauts will stay on the moon twice as long as any of their predecessors, and its period of lunar orbit after the landing will be extended to two full days. The lunar vehicle will yield "an order of magnitude" increase in the mobility of the astronauts, who will make three geological traverses in 66 hours on the moon.

Apollo 15 will be a "cliff-hanger" both for astronauts and their earth-bound followers. The landing site is in a narrow mare region near the Hadley Rille, a meandering, mysterious v-shaped erosional feature. Nearby will be the Apennine Mountains, where the astronauts will search for outcrops of lunar bedrock.

After gliding over the Apennine Mountains, the Apollo 15 astronauts will bring their lunar module down on a narrow mare region near the Hadley Rille. From there will be mounted three geological traverses: southwest across the mare to investigate and sample the intersection of the Apennine Mountain front and the 1,000 foot-deep rille; southeast around a cluster of craters to sample widely spaced portions of the mountain front; and north along the rille to examine and sample a complex of domes, craters and scarps. They will use a hand-held drilling unit to bring up 10 ft. cores of lunar material and to emplace heat flow probes, and they will deploy a lunar science package somewhat more complex than those left by Apollo 11, 12, and 14.



To reach the Hadley landing site the Apollo 15 lunar lander will navigate over two of the largest mascons—regions of gravitational anomaly—and almost through a mountain pass. Their approach will not be—as heretofore—in parallel with the moon's longitude, so with every lunar orbit they will have to seek new features, not familiar landmarks.

The Lunar Rover

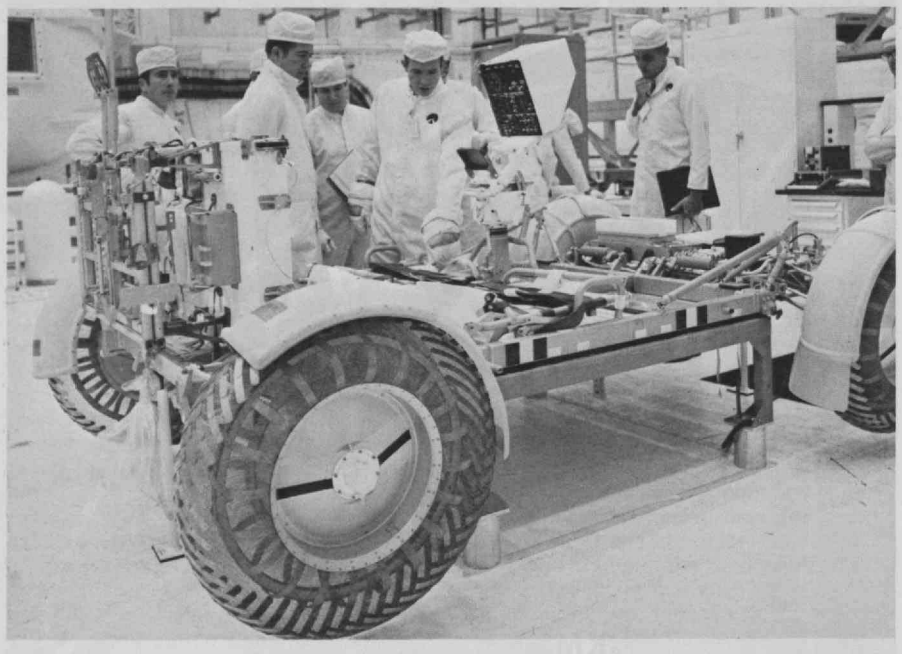
When Captain David R. Scott graduated from M.I.T. in 1962 (two degrees, Master of Science and Engineer in Aeronautics and Astronautics, with a single thesis: "Optimum Statistical Operations with Celestial Fix Data for Interplanetary Navigation"), he would hardly have guessed that as the Commander of Apollo 15 (*see above*) he could be the first man to drive a motorized vehicle on the surface of the moon.

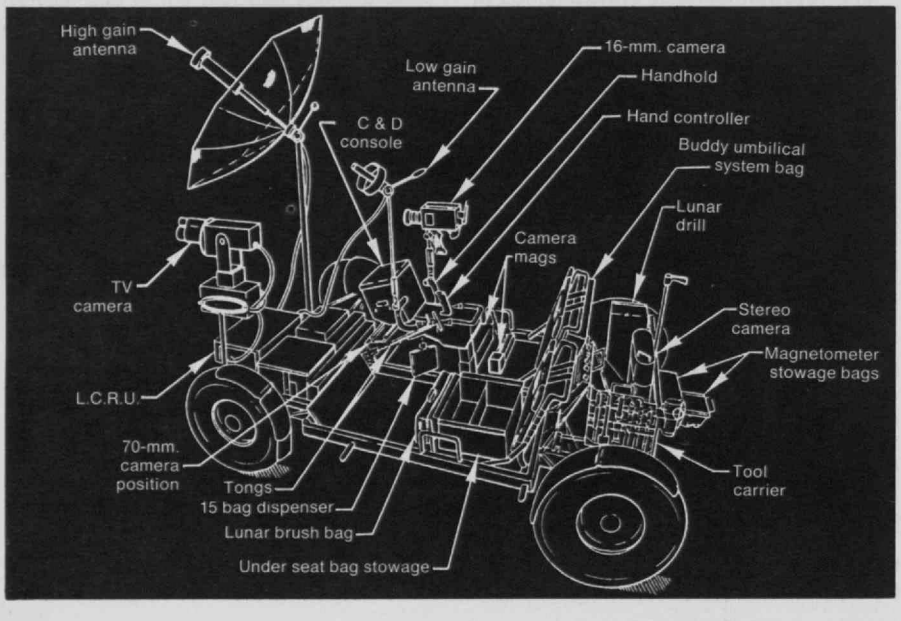
His "moon buggy"—technically the Lunar Rover Vehicle (L.R.V.)—will have some very special talents. It weighs 480 pounds on earth and will carry up to 1,000 pounds—a fair gross-to-net ratio by terrestrial standards. Its wheelbase is 7'6", length 10'2", width 6', and clearance about 14". The steering mechanism can operate both front and rear wheels, giving a turning radius exactly the same as the vehicle's overall length.

L.R.V.'s "tires" are a mesh woven of zinc-coated piano wire with titanium threads on the outside and titanium buffers on the inside. Each wheel is driven by a ¼-h.p. electric motor; if one or even two fail, the other two can move the L.R.V. Power steering is accomplished by two 0.1-h.p. electric motors, one for each axle; if one fails, the other can still be used to keep L.R.V. on its course.

Power is from two nonrechargable, 36-

The Lunar Rover Vehicle which Apollo 15 astronauts will use on the surface of the moon is perhaps the most complex and highly specialized motorized vehicle ever built; N.A.S.A. optimistically calls it "a manned spacecraft on wheels." On earth L.R.V. weighs less than 500 pounds; in lunar exploration it will carry about 1,000 pounds—as weighed on earth: two astronauts and their life-support equipment and 200 pounds of scientific experiments and rock samples. The whole vehicle folds compactly for transportation to the moon; the forward and rear sections of L.R.V. fold over the center section and then the four wheels fold inwards over the chassis. Springs will unfold wheels and chassis on the lunar surface —leaving the astronaut to unfold the crew seats and put the instrument console in place. In the photograph Apollo 15 Commander David R. Scott and Lunar Module Pilot James B. Irwin (left) pose with L.R.V.; Scott is pointing to the two folded seats. (Photo: N.A.S.A.)





volt, silver-zinc batteries; their 121-ampere-hour capacity is enough to drive L.R.V. a total of 40 miles—about twice as far as the Apollo 15 program requires. Maximum speed is 9 m.p.h., cruising speed 5 m.p.h., forwards or backwards. L.R.V. can climb a 20° slope and stop on a 30° slope; it can climb step-like obstructions up to 1′ high and cross crevasses up to 28″ wide.

L.R.V. has a dead-reckoning navigation system to report speed, total distance travelled, and the direction and distance to the Lunar Module throughout a traverse. Its Lunar Communications Relay Unit will transmit directly to earth the astronauts' voices, biomedical data, and color television images from a camera mounted near the front of L.R.V. The images from a camera moving across the surface of the moon will be exciting viewing for everyone, but they promise a unique advantage for earth-bound geologists: if the camera records a surface detail of interest the scientists can ask questions about it while the astronauts are there to answer. If it shows a rock the geologists want, the astronauts can be instructed to collect it. Of L.R.V.'s 1000-lb. capacity, the two astronauts and their life-support equipment will claim 800 lbs. The remaining 200 lbs. will be devoted to scientific experiments, tools, and collected rock samples.

Toward a History of the Moon

Two years after man first left his tracks on the moon, his notions about the origin and history of that planet are markedly changed. But his questions are far from answered, and—like most objects of scientific inquiry—the moon now seems to present some unanswerable riddles.

On the basis of evidence returned from three Apollo landings and from many satellite missions, John Wood of the Smithsonian Astrophysical Observatory this spring proposed, at a seminar of the M.I.T. Department of Earth and Planetary Science, a narrative history of the moon. The moon appears to consist of three kinds of rocks, he said: crystalline basalt; assemblages of chipped particles of such basalts, pressed together with sufficient heat to melt the particles at the points of contact without destroying the crystalline structure itself; and assemblages of chipped basalt particles held together with glassy material.

These three classes of materials are now jumbled together in heaps of rocks, stones, and dust across the lunar surface; no one has yet seen any of the basaltic material in outcrops where it seems to be in its original consolidated condition. Theories of the effects of meteorite impacts are adequate to explain the moon's jumbled surface aspect. A good deal of fracturing and "splash-

ing" must occur whenever a meteorite strikes, and the very local heat of impact explains the "glassy" material.

But no theory is yet adequate to explain the gravitational eccentricities which startled space scientists monitoring the first satellites in moon orbit. From these eccentricities have come the postulated mascons—"pools" of lunar material heavier than the rest, hidden beneath the pulverized surface.

Dr. Wood's lunar history reads like this: First, remarkably rapid accretion of the basic materials of the moon over a period of 1,000 to 3,000 years—probably at the same time, some 4 billion years ago, that the earth forms in exactly the same way. The energy of gravity, accumulating in such an accretion, yields heat—in the moon's case enough to agglomerate the materials without altering their basic crystal structure.

The radioactive decay of potassium, uranium, and thorium in the original lunar (and terrestrial) material provides a new source of accumulating heat within the moon; some one billion years later, with the gravitational heat largely dissipated, heat from this new source melts some of the core material and it flows to the surface where it collects into pools, cools, hardens, and becomes the mascons.

As meteorite impacts continue—the present rate, according to Apollo seismograph data, is an average of one measurable meteorite striking the moon per day—the mascons are gradually buried under the layer of rubble, as are most of the primary features of lunar topography. Apollo astronauts have thus far not unearthed any of them.

Though it is supported by many technical studies, this is at best a sketchy history of the moon, Dr. Wood agreed. It is consistent with most Apollo findings, but it can be amplified in detail or modified in the whole without spoiling anyone's professional reputation.

Tidal Moonquakes

Since Apollo 12 flew to the moon in 1970, U.S. geologists have had one—and since Apollo 14 in 1971, two—seismic stations in continuous operation on the lunar surface. The result has been an order-of-magnitude increase in our knowledge of lunar geology, Gary V. Latham of Columbia University's Lamont Geological Observatory told the American Physical Society in Washington this spring. Though the new seismic information seems to some to accumulate very slowly—and would be far more complete had the Apollo 11 seismic station survived to provide a third signal for triangulation—Dr. Latham proposed instead that "it is well to be reminded of how far we have come." None of the new details of lunar geology which he reported to the A.P.S. is inconsistent with John Wood's view of lunar history (*see above*), and some is remarkably illuminating of detail.

Because it has no atmosphere and no life, the moon is an ideal seismic subject; there is no background of miscellaneous vibration, and seismometers can be operated at such sensitivities that surface motions of as little as 1Å can be detected.

As most readers will remember, the first hint that the moon had remarkable seismic characteristics came when the lunar module of Apollo 11 was deliberately crashed into the surface of the moon. To the astonishment of seismologists, the vibrations persisted in the moon for several hours; on earth such reflections would have lasted only a few minutes. Analysis of this result has now led most geologists to agree that the moon must be largely homogeneous—without the substructures of mantle, core, and inner core postulated for Earth.

In the records of seismometers placed by Apollo 12 and 14, geologists have now come to recognize two kinds of events. One represents meteorite impacts—roughly one a day. The man-made impacts—which were "absolutely vital" for calibration in the lunar seismology program, Dr. Latham said—assure him that present instruments can detect every lunar impact of a meteorite the size of a grapefruit or larger, even if it strikes on the opposite side of the moon.

The other class of seismic events represents what Dr. Latham calls "a truly remarkable set of circumstances." These are earthquake events somewhere on or in the moon, and they are almost all identical. They seem all to occur in the same distinct location, at monthly intervals corresponding to that time in the moon's orbit when it is closest to Earth. "You could set your watch by their timing," he said.

This regular pattern suggests to Dr. Latham a tidal event, and he hypothesizes a small body of liquid rock—magma—somewhere 50 to 700 km. under the lunar surface—whose movement represents an earth-caused tide. The total energy release is very small—10^{14} ergs/y., compared with the earth's annual earthquake energy of 5×10^{25} ergs/y. "We cannot be dealing with a hot, seething core," he says; "but the moon is not a completely dead body." The third seismometer to be placed on the moon by Apollo 15 should help resolve the uncertainties of location and identity.

A Cosmic History

Dr. Wood's hypothesis about lunar history (*see above*) is consistent with the history displayed by cosmic ray tracks in moon rocks returned by Apollo 11, 12, and 14. Energetic atomic particles leave trails of damage as they pass through crystal structures, and chemical etching reveals these tracks. Because the particles are mostly stopped in surface rocks on the moon, their tracks provide a kind of written history that tells how long a rock resided near the surface and which side was most exposed.

A favorite example of the application of this analysis by scientists at the General Electric Research and Development Center is Rock 1207 from Apollo 12. It was brought to within a few meters of the lunar surface some 70 million years ago and then was raised to the surface 1.7 million years ago. One million years later it was turned over, and 9,000 years ago—still on the surface—it was spattered with molten glass.

Assigning time scales to such cosmic events is possible because cosmic ray tracks in the glass of the Surveyor III television camera, exposed on the moon for over two years and returned to earth by the Apollo 12 astronauts, provide calibration. This recovery has been of "immense value," Robert L. Fleischer of General Electric told members of the American Physical Society this spring.

A Magnetic History

Magnetometers left on the moon by Apollo 12 astronauts yield two kinds of results, and both of them are hard for moon-watching scientists to interpret. Charles P. Sonett of N.A.S.A.'s Ames Research Center described them at this spring's American Physical Society sessions:

◇ A residual field, probably frozen into the lunar rocks "at least 3.2 billion years ago and possibly much earlier." Its origin is uncertain, he said, but it is likely a residual of a more intense field—such as one which could have been caused by the earth in close proximity to the moon during the latter's accretion.

◇ A small field caused by electrical currents flowing in the lunar interior, due to electromagnetic induction from the interplanetary magnetic field which accompanies the solar wind (the phenomenon of eddy currents seen in laboratories on earth). The strength of such a field depends on the conductivity, and hence possibly on the temperature, of the lunar rocks through which it flows. Lunar observations suggest that the conductivity (and perhaps the temperature) increases steeply with depth to about 270 km., then falls for the next 100 km., then resumes the rise that could associate increasing depth with increasing temperature.

All possibilities now suggested for the moon's strong fossil magnetic field "have difficulties connected with them," said Dr. Sonett. The inductive field discontinuities "strongly suggest that a material change is taking place" between 270 and 300 km. below the lunar surface. Nothing here can give great comfort to the lunar his-

tory proposed by Dr. Wood at M.I.T. this spring (*above*). Nor, however, great discomfort.

The Maturing of Radio Interferometry

Radio astronomy was born when the focussed antennas and sensitive receivers of World War II radars were turned to the sky. Wholly new dimensions were suddenly given to one of man's oldest sciences when it became apparent that visible light represents only a small portion of the energy which reaches us constantly from known and unknown sources in the universe.

Indeed, a whole new class of celestial objects was suddenly revealed—stars which are barely visible in conventional optical instruments but which radiate immense amounts of radio energy. The discoveries of nuclear physics had provided an understanding of visible stars. But these primarily radio sources were and remain a new mystery, the extent of which is revealed by the name they were given: quasistellar radio sources, shortened to quasars.

Radio waves—far longer than light waves—presented new problems to astronomers: their length made impossible a truly sharp focus on their sources, for sharpness depends upon the ratio of the size of the instrument to the wave length being observed.

Then came the atomic clock, which gave the possibility for truly accurate timekeeping at many distant points. Canadian astronomers early in the 1960's conceived of linking radio observatories together to create what becomes in effect a single instrument spanning half the globe, whose focus for radio waves could be immensely sharper.

The technique is to compare radio waves received simultaneously from a single source at two points on earth; there is a difference in the phase of signals as received, because the waves have travelled slightly different distances to reach the two antennas; from computer analysis of these differences comes a hint of the shape and size of the original radio source. It is exactly the same phenomenon, enlarged to a continental scale, that was used to demonstrate the wavelike nature of light more than a century ago; it is also in many respects analogous to the increase in detail achieved by stereo photography.

This new way of using interconnected radio telescopes—called very-long-baseline (or intercontinental) interferometry—had now become the standard tool for studying quasars. And while some of its present practitioners were announcing some remarkable new results (*see below*), the American Academy of Arts and Sciences this spring conferred upon the pioneer developers of V.L.B.I. the coveted Rumford Premium for an "important discovery or useful improvement on heat or on light" made on the American continent. The recipients were members of three V.L.B.I. groups—seven at M.I.T., nine in Canada, and five in a group divided between Cornell and the National Astronomy Observatory.

The "Conspiracies" of Quasar 3C279

The window which radio astronomy opened for the first time turns out to reveal an enormous, constantly changing universe the shape and size of which remains largely unmeasured, its mechanism unconceived.

At the American Academy of Arts and Sciences symposium in connection with its award of the Rumford Premium (*see above*), David L. Jauncey of Cornell University hypothesized that quasars represent a common phenomenon in stellar evolution. Similarities among the 50 now known are such that—if we assume the correctness of conventional measurements of astronomical time—the same things which must have happened long ago to the oldest quasars are still happening to young ones.

This hypothesis assumes that quasars gradually expand from very small, intense energy sources to larger, diffuse ones. Observations reported by Dr. Jauncey confirm the hypothesis for several quasars studied by long-baseline interferometry at intervals for over two years; expansion is "an inescapable conclusion," he said. But Dr. Jauncey has also studied an intense radio source in Virgo which in a similar length of time has remained remarkably constant in both size and intensity. How can this be?

If you make a model of an astronomical object which could by some mechanism radiate energy in the pattern in which it is observed by earth-bound astronomers using V.L.B.I. techniques, you end up with a quasar which looks like an expanding dumb-bell: two discrete, interrelated, and essentially identical energy sources gradually separating from each other. This in itself is an extraordinary postulate, and several participants in the V.L.B.I. symposium expressed their uneasiness with this model for all quasars. But no other model fits as well. What mechanism of energy release can somehow be related to this two-part geometry?

The two-source geometry was confirmed by Irwin I. Shapiro, Professor of Geophysics and Physics at M.I.T., in the case of the quasar known—because of its position in the sky—as 3C279. In October, 1970, he and his associates observed this quasar with a remarkably precise interferometer composed of M.I.T.'s Haystack Observatory and Caltech's Goldstone Antenna—a system dubbed the "Goldstack." The two radio sources of 3C279 seemed to be separated by a distance representing 1.55 x 10^{-3} seconds of arc.

Four months later the same two sources were observed again, and to the observers' astonishment their separation had increased by about 10 per cent. If 3C279 is as far from earth as its "red shift"—the widely accepted method of determining astronomical distance—demands, then the two sources are moving apart at some 10 times the speed of light.

The result deepens the drama and mystery which surround quasar observations. All kinds of physical theorems depend for their validity on the concept that no object or particle can travel faster than light. The "red shift" method of measuring astronomical distance is also a fundamental cornerstone. And Professor Shapiro insists that the precision of "Goldstack" is so great that micro-arc-seconds of separation can be reliably seen. It is a series of what Professor Shapiro called "conspiracies" to which no one at the Academy's symposium had a clue.

MATHEMATICS

All Possible Black Holes

Specialization, as is well known, is the process of learning more and more about less and less until everything is known about nothing. At the April meeting of the American Physical Society in Washington it became evident that the long-awaited end point of this progress has very nearly been reached.

The nothing in question is a black hole. A star, at the end of its life, is believed to collapse under its own gravity until it becomes so dense that not even light can escape from its surface against the enormous local gravitational field. Such an object, into which anything can go but out of which nothing can come, is known as a black hole. On the classical principle that what cannot be observed does not exist, a black hole is a promising candidate for the role of nothing (although it retains a Cheshire-Catlike observability by virtue of its gravitational field, and—possibly, sometimes—magnetic one).

What can be said of such an object? It can be described mathematically with the help of general relativity theory, as developed by some of Einstein's intellectual descendants. The simplest possible black hole—a collapsed star of perfect sphericity—is described by the equations of the mathematician Schwarzschild.

But what of the more usual, nonspherical star? Robert M. Wald, of Princeton, addressing the American Physical Society's session on General Relativity and Miscellaneous Theory, began by assuming that as one makes one's pre-collapse star progressively less symmetrical, the black hole into which it disappears will become progressively less like a Schwarzschild black hole—

but that nothing drastic will happen at any point in this hypothetical progression into realism. In that case, (to quote Dr. Wald's "popular version") "gravitational collapse must result in black holes whose properties can be mathematically obtained by smooth variation of the properties of the Schwarzschild black hole.

"Thus, it is of great interest to find all the solutions of the Einstein field equations of general relativity which describe such black holes, since then one would have a complete and detailed knowledge of all possible final states of gravitational collapse."

A variety of possible black holes is to be found in the "Kerr-Newman" black holes. These have the properties of angular momentum and net electric charge ("the Schwarzschild black hole being a special case of the Kerr-Newman black hole, with no charge or angular momentum"). Newman and others assembled this collection of holes from a range of spinning holes devised by Kerr and a family of charged holes which have been knocking around the literature for fifty years or so.

But charge and angular momentum are not everything, reasoned Dr. Wald. It might be supposed, therefore, that the Kerr-Newman black holes are "only special cases of a much wider class of black holes."

Not so, says Dr. Wald. He has carried out "a complete investigation of all solutions of Einstein's equations describing black holes which can be mathematically obtained by smooth deformation of the Schwarzschild black hole," and finds that the Kerr-Newman black holes "are indeed the only such black holes." Which implies that, always, no matter what it is that collapses, "the generic final state of gravitational collapse is a Kerr-Newman black hole."

PHYSICS

Inside the Proton, Three Quarks

The dire results that followed when the snark proved to be a boojum are familiar to all. No such misadventure, nor any kind of success, have yet fallen upon the hunters of the quark, that hypothetical entity whose electric charge comes in thirds of an electron. But it may be that partons, in fact, are quarks.

And what are partons? Partons are parts of a proton or a neutron. Their existence is currently the best way to account for what is observed when protons or neutrons are bombarded with very high energy electrons (around 10 billion electron-volts)—if the resultant scattering of the electrons is studied with sufficient attention to detail.

In essence, the new picture of the proton —which emerged at a conference in Kiev last September—is that it is not a single entity, but instead has a grainy internal structure. Professor Victor F. Weisskopf, head of M.I.T.'s physics department, has described this change as almost as startling as Rutherford's discovery, 60 years ago, that the atom, previously indivisible, had a nucleus and an outer electron-cloud.

The need for partons, and the fact that quarks could play their role, is explained in the June, 1971, *Scientific American* by Henry W. Kendall, Professor of Physics at M.I.T., and Wolfgang K. H. Panofsky, Director of the Stanford Linear Accelerator Center (SLAC). The Stanford Linear Accelerator (which is two miles long) was used to accelerate the electrons, and the measurement of the angles and energies at which they left the proton and neutron targets (in fact, hydrogen and heavy-hydrogen) was the work of a team drawn from Caltech, M.I.T. and SLAC itself.

The electron is a convenient particle for investigating the insides of other and heavier particles, in that its interaction with other particles is predominantly through the well-understood electromagnetic forces rather than through the somewhat obscure nuclear (or strong) ones. This means that it is possible to "see inside" a fundamental particle, and perhaps learn how it is constructed and what its constituents, if any, are like.

A collision between an electron and, for example, a proton may be either elastic (total kinetic energy remaining unchanged) or inelastic, in which case some kinetic energy is lost in the production of new particles. The mechanisms of the two kinds of collision are quite different, and so, therefore, are the kinds of information obtainable from the results.

In either case, the observational task is to measure the probabilities of the electron's being scattered at any given angle, over a wide range of scattered energies. This gives the "cross-section" of the proton or neutron (in a sense, its effective size) for that particular kind of scattering at that particular electron energy (a proton or neutron, like many other things, behaves differently according to how hard one hits it). The business of the theoretician is to devise a model or picture of the structure of the proton or neutron that will reproduce the observed cross-section—and whose cross-section will vary with energy in the observed fashion.

In experiments carried out by M.I.T. and SLAC physicists with electrons having energies up to 19 billion electron volts, the inelastic scattering cross-sections of both protons and neutrons have proved to be as much as 40 times what was predicted by then-current theory. Oddly enough, the response of the theorists to this observation has been to suggest that there are entities scattering the electrons that must be very much *smaller* than a proton or a neutron. It is these very small objects that are called "partons" (by their inventor Richard P. Feynman of Caltech, who—like Dr. Murray Gell-Mann, the inventor of quarks—is an alumnus of M.I.T.). And the partons might as well be quarks. As far as the inelastic scattering of protons and electrons is concerned, the proton and the neutron can both be represented by three quarks, in different configurations.

ASSESSMENT

More Technologies, But Fewer Chosen

Many people see in America today an upsurge of superstition—astrology and other kinds of fortune-telling—and a widespread rejection of reason. Dr. Murray Gell-Mann, Nobel Prize-winning fundamental physicist (*see* Technology Review, *January 1970, pp. 65-66*), is clearly one of the most successful reasoners of our time, as the above mentioned vindication of the quark theory demonstrates, but he finds the growth of unreasonableness to be not entirely unreasonable.

He sees it as a kind of backlash against "narrow rationality pervading government, universities, industries, and other parts of our national and even international life. Youngsters tired of the tyranny of badly programmed computers," he goes on (*Physics Today,* May 7, 1971, pp. 23-25), "and of people who act like badly programmed computers, are turning to tarot cards and charlatans."

Somehow the fruits of reason—science and technology—must be made more acceptable to those who uphold "human . . . natural . . . spiritual values difficult to subject to rigorous analysis." Among the approaches that Dr. Gell-Mann suggests is what he calls the "narrowing cone" principle:

"Suppose we are indeed to abandon the old principle of building anything we know how to build because we know it can be done, if only the cost in conventional and easily quantified terms can be kept within bounds. Suppose we now try to include also the cost in human, social and environmental terms and to deploy, as I believe we should in the future, only a smaller and smaller fraction of what is technically possible, according to the principles of technology assessment and control." In other words, suppose "we make use of a narrowing cone of the technical possibilities generated by science and engineering . . . ".

Would that mean doing less technological and scientific research? Dr. Gell-Mann holds that it would mean doing more. "We need a great deal of science and technology in order to provide a much longer menu of possibilities from which society can select the few tasty and nutritious dishes that are selected by the technology assessment process. We

want to feel free to do research on and sometimes to develop . . . technologies that we can then renounce as inappropriate on total human appraisal."

A lead in this direction has already been provided, says Dr. Gell-Mann, by the Pentagon—"unwittingly or unwillingly perhaps." The civilian sector should do likewise: "develop a wide variety of technologies, and then . . . throw most of these technologies away as being unsuitable on careful consideration."

At the gates of a science-based heaven, it appears, technologies would be treated as people were in the pre-industrial version—many would be called but few would be chosen. One wonders whether the trick can be done without too much gnashing of teeth.

Computerizing Consumption

Consider two bottles of insect repellent: the 1.75-oz. one contains 50 per cent diethyl tolnamide; the 2-oz. one contains 75 per cent ethyl hexanediol. Which do you buy?

Or two refrigerators—one costs $359, one $292, for the same capacity. The former costs $2.50 per month to operate, the latter $4.75. The former costs $804 over fifteen years of use, the latter $1,097. How are you to know?

Those who make large purchases, particularly industry or government, go shopping with a list of specifications, and the contract is written to guarantee a certain performance. The humbler consumer should have the same surety, suggested Morris Kaplan, Technical Director of the Consumers Union, to the National Academy of Engineering's late-April symposium on product quality, performance, and cost. He should be able to get data—easily—on a product's quantity, performance, initial cost, operating cost, methods of use, care and maintenance, durability, safety, and social cost.

Industry is certainly accustomed to supplying performance data on its products, although this information is often not offered, or even available, on consumer goods. Nor does the customer know, often, what to ask, or how to define in precise terms what he needs and expects.

And so, Mr. Kaplan comes to the universal solution: put it on the computer. Computer terminals could be scattered, in booths, about a shopping area, or hooked up to a telephone. A consumer would state the product he wished to buy, and the computer would ask a series of questions about his needs: For a refrigerator, for example, the computer would ask how much space was available, the price range, the cost of power, the options wanted, the size of the family, and so forth. With this set of specifications, the computer would print a list of those refrigerators that fitted the buyer's needs, and where to buy them locally.

A better match between the consumer and his goods is certainly to be had, Mr. Kaplan said, and with better matching, and the resulting feedback to the manufacturer, "consumer sovereignty" might induce a number of benefits. Products would be designed with less flash and more durability and safety. Our natural resources, and our human ones, might be more economically used. Money would not be wasted on the wrong product. And the consumer's faith might be rebuilt.

ENERGY

Energy Consumption Is Nonlinear

The U.S., with 6 per cent of the world's population, uses 34 per cent of world energy output; the U.S., Western Europe, and the U.S.S.R., with less than 25 per cent of the population, consume more than 70 per cent of all energy generated.

No one is surprised at these figures—cited by Frank A. Ritchings, Vice President of Ebasco Services, Inc., at an M.I.T. Alumni Seminar this spring. Nor is anyone unaware—at least in the abstract—of how gross would be the change if everyone were to have as much energy at his fingertips as Europeans and Americans do. In 1968, world energy consumption was the equivalent of 1,727 kg. of coal per person; to increase this 30-fold is almost unthinkable.

Less familiar to his audience were Mr. Ritchings' figures on local variations in power consumption and energy resources in the U.S. Taken by Census Districts, New England—despite its cold climate—stands lowest in U.S. per-capita energy consumption: 6 per cent of the people used only 4 per cent of the energy in 1965. Next came the South Atlantic states, where 15 per cent of the U.S. population used only 11 per cent of the energy. Highest per capita energy consumption was in the "West South Central" Census District—Texas, Oklahoma, Arkansas and Louisiana. The statistics reveal no clear pattern relating energy consumption to economic activity, but, said Mr. Ritchings, "It seems significant that energy consumption per capita in the areas having substantial reserves of gas and oil is more than twice that of areas deficient in fuel reserves."

Converting Coal Gas to Electricity

Fission, breeder, and fusion reactors *(see below)* are not the only possible response to the demand for more efficient, low-pollution power sources. Working under a grant from the Air Pollution Control Office of the Environmental Protection Agency, Fred L. Robson and Albert J. Giramonti (M.I.T.'62) of the United Aircraft Research Laboratories now propose a unified combination of coal-gasification with a gas-turbine- and steam-powered central station in which sulfur oxide emissions would be eliminated while station efficiency was increased to nearly 55 per cent.

Reviewing the research at an M.I.T. seminar on energy resources for the future, Hoyt C. Hottel, Emeritus Professor of Chemical Engineering, this spring called the U.A.R.L. system a uniquely promising development for future conversion of conventional fuels to electric energy.

The U.A.R.L. system begins with coal, converted into gas by familiar processes which include enrichment of the gas and absorption of over 98 per cent of the sulfur content of the coal, which is converted into elemental sulfur. The resulting gas would have a heating value of 177 B.t.u./cu.ft. (as compared with natural gas at 1,000 or more B.t.u./cu.ft.) and its processing would add about 22¢/million B.t.u. to the raw fuel cost. But Dr. Robson and Mr. Giramonti propose that advanced systems might by 1980 reduce the increment to 12¢/million B.t.u.

The sulfur-free coal gas is used to fuel a gas turbine (producing directly two-thirds of the total power output), and in turn its hot exhaust gases power a subsidiary, conventional steam turbine from which comes the remaining one-third of the total power. With present technology, the gas turbines could be operated with inlet temperatures up to 2000°F. and the combined station efficiency might be higher than 40 per cent—matching the most efficient central-station efficiencies now attained.

But Dr. Robson and Mr. Giramonti propose that with "extensive use of aerospace technology"—meaning metallurgical and cooling techniques now being developed for aircraft turbines—inlet temperatures as high as 2,800°F. could be attained in such a generator by the 1980's, and this "third-generation" combined system might operate at efficiencies of over 50 per cent.

In either case, the so-called COGAS combined-cycle power system would reduce sulfur oxide emissions by over 95 per cent and thermal pollution to cooling water by some 40 per cent—the latter because of increased efficiency and because much of the rejected heat is returned directly to the atmosphere through stack gases instead of being accumulated in a condenser.

The Breeder—the Future Reactor

The fission reactor is now the preferred

source of electric power in many parts of the U.S. Construction and operating costs are often no higher than conventional steam plants, and environmental problems are often more easily solved with nuclear than steam power.

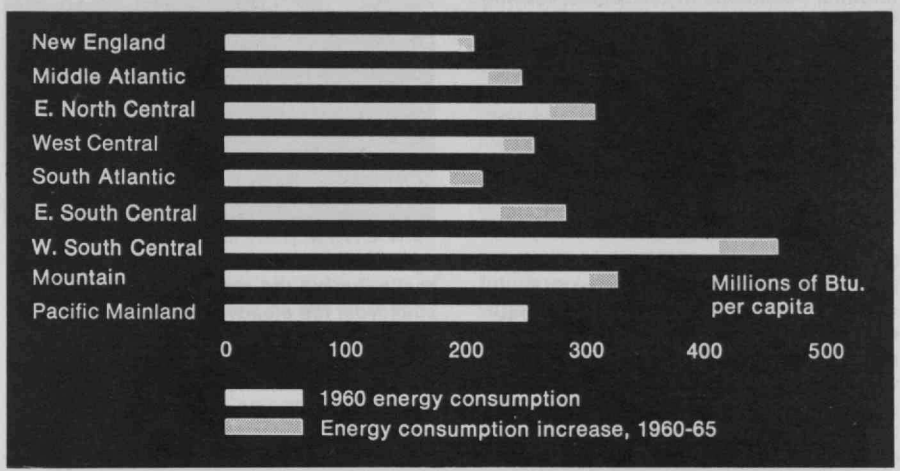
But fuels for fission reactors of the type now in service may be plentiful for only about 20 years at the present rate of expansion, and by the year 2000 the price of uranium may have advanced from today's $8 per pound to over $15, Manson Benedict, Head of the Department of Nuclear Engineering at M.I.T., told the National Academy of Sciences this spring.

Dr. Benedict and other speakers at the "Energy for the Future" session called for major research and development effort on breeder and fusion reactors to provide for the nation's ever-increasing energy requirements without environmental degradation (on fusion see p. 56).

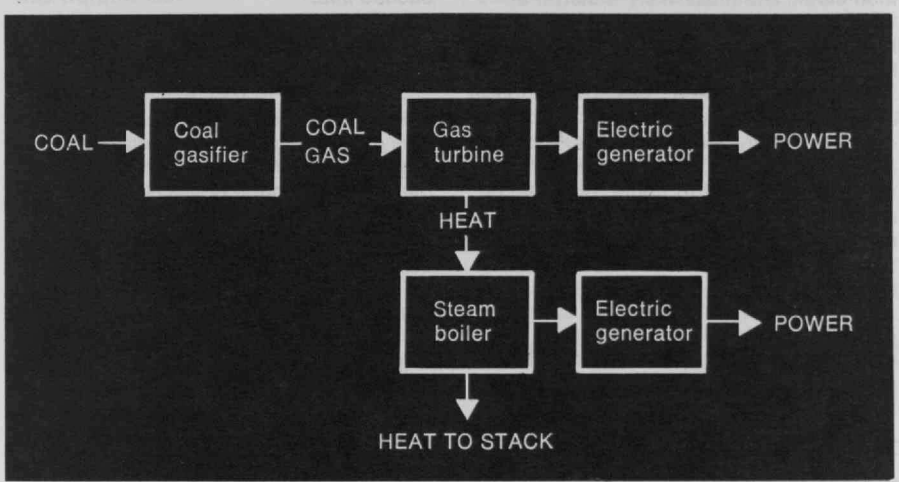
Fission reactors of the type now in use for power generation obtain most of their energy from the scarce uranium-235 isotope, which occurs in natural uranium only to the extent of about one part in 140. But the more abundant uranium-238 isotope (over 99 per cent of natural uranium) will serve as raw material for the production of fuel in breeder reactors.

The breeder reactor has two advantages: it produces fissile plutonium, from uranium-238, rapidly enough to replace the fuel used in the powering reaction, and therefore consumes very little uranium; and its low uranium consumption makes the price of energy almost independent of the price of uranium.

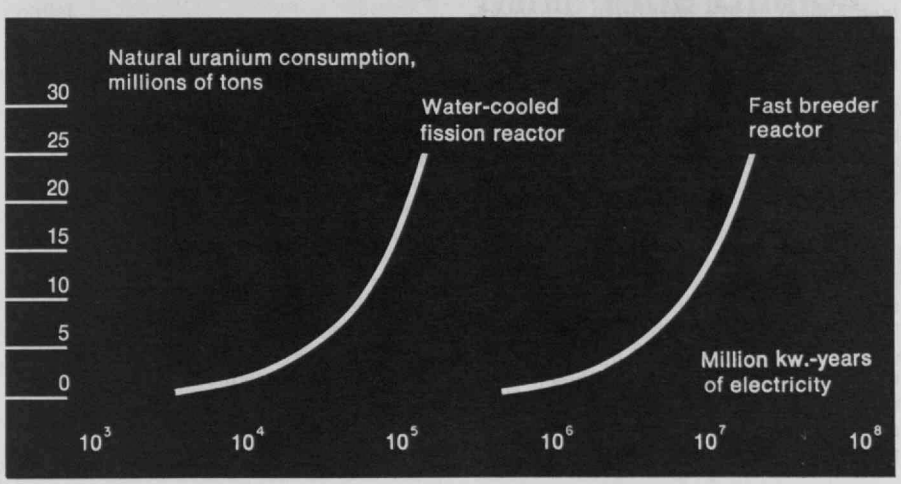
"At the present rate of electric generation in the U.S.—300 million kW.—fast breeder reactors fueled with U.S. uranium resources . . . could provide all our electricity for 64,000 years," Professor Benedict told the Academy. They would multiply the effectiveness of U.S. nuclear fuel resources more than 100-fold, he



In a broad sense, U.S. energy consumption is population-related, Frank A. Ritchings, Vice President of Ebasco Services, Inc., told M.I.T. alumni at a seminar this spring—but there are some surprising differences. New England, with 6 per cent of the U.S. population, used only 4 per cent of the energy in 1965; in the previous five years, New England energy consumption had increased only 15 per cent. These figures compare with maximum consumption of 16 per cent of U.S. energy by 10 per cent of the population in the West South Central Census Division, and five-year growth rates of 27 per cent in the South Atlantic and 33 per cent in the East South Central Divisions.



A significant adaptation of aerospace technology to industrial problems is promised by research on coal-gas-fired combined-cycle power systems now in progress at United Aircraft Research Laboratories. A conventional gasifier—including desulfurization equipment—supplies fuel to compressor and power turbines driving an electric generator, and turbine exhaust gas then provides heat for a conventional steam turbine, driving a second electric generator, before it is exhausted to the atmosphere. As improved technology makes possible an increase in turbine inlet temperatures between now and 1990, combined station efficiency could rise from just less than 35 per cent to at least 50 per cent, according to Fred L. Robson and Albert J. Giramonti of U.A.R.L.



Nuclear fission reactors now generating power in the U.S. use only the uranium-235 isotope which comprises less than 1 per cent of natural uranium. But the breeder reactor, if it can be developed, will use plentiful uranium-238—and use it more efficiently, at that. Hence the urgency of developing breeder reactor research and construction, Manson Benedict, head of the M.I.T. Department of Nuclear Engineering, told the National Academy of Sciences this spring.

said, "and it is this tremendous extension of our fuel resources which makes development of the breeder reactor so challenging and important."

Dr. Benedict recalled that the first breeder reactor to generate electricity was demonstrated in the U.S. in 1951; since then two larger experimental units have been operated, and facilities for testing breeder reactor components continue in development. Meanwhile, Russian, English, and French programs to construct demonstration breeder reactors "without waiting for the exhaustive testing of components now characteristic of the U.S. program" are proceeding; and he forecast that "unless these foreign projects run into major difficulties, fast breeder reactors will become commercially available abroad many years earlier than in the U.S.

"There is a definite possibility that in the 1980's U.S. power companies will be buying breeder reactors from France, England, or Germany," Dr. Benedict told the Academy. He urged a national program to build demonstration breeder reactors to begin at once—at best it will take "at least seven years to bring the first demonstration plant into operation," Dr. Benedict said—financed if necessary by a federal tax on electricity.

The Breeder's Swell Problem

Nuclear engineers working on the design of breeder reactors (*see above*) face one major technical problem. The problem was discovered in 1966 at the United Kingdom's Dounreay Fast Reactor, a 60-MW. liquid-sodium cooled experiment commissioned in 1959. It was found that the stainless-steel cladding of the fuel-pins had swollen (rather like dough in an oven), accompanied by the appearance of microscopic voids within the steel.

This unexpected phenomenon, which seems at first sight to write off the use of steel in breeder reactor cores, is a cumulative process, and is temperature-dependent. It is, lamentably, most pronounced at the temperatures which are of greatest interest in the design of breeder reactors: in the range of 550 to 700°C., one year in the Dounreay reactor results in 316 steel expanding by about 10 per cent.

The story is told—with what may be the makings of a happy ending—in *New Scientist and Science Journal* (March 25, 1971, pp. 664-667) by R. Stuart Nelson, a metallurgist at the U.K. Atomic Energy Authority's Harwell research establishment. The article is based on a paper presented the same day to a British Nuclear Energy Society conference on void-formation.

Because the swelling process is dependent upon accumulated irradiation dose, the Dounreay reactor produces its effects too slowly to suit the needs of research metallurgists. At Harwell, a variable-energy cyclotron has been used to generate ion beams which can simulate in a few hours the effects of years in a fast-neutron reactor core. Test samples of metals can be implanted with helium before irradiation to simulate the fission-product gas which, according to current theory, plays a key role in the unwanted void-growth. The accuracy of the simulation was established by observing similar effects in specific metals placed in the Dounreay core and in the cyclotron beam.

Irradiation damage consists essentially of the displacement of atoms from their normal positions in the crystal lattice; the displaced atoms go into "interstitial" positions in the lattice, leaving vacancies behind them. Both the atoms and the holes move about in the lattice. The swelling phenomenon arises when the vacancies, instead of being filled by other interstitial atoms, persist, and link up into larger holes. The Harwell metallurgists therefore searched for materials in which the vacancies and interstitials would tend to find one another.

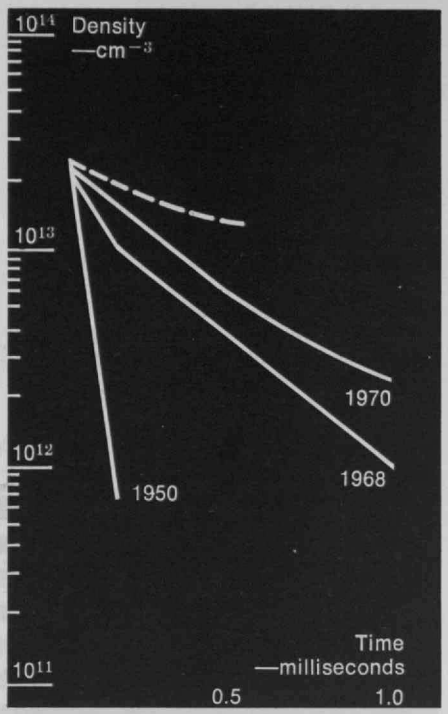
One answer, according to Dr. Nelson, is to cold-work the conventional 316 stainless steel, to produce a dense pattern of linear faults within its crystal structure. The interstitial atoms and vacancies move toward the fault lines, migrate along them, and mutually correct themselves. The other promising line of work is to seek out something better than steel. The most likely material at the moment is a nickel alloy, nimonic PE 16, heat-treated so as to contain a fine-scale dispersion of precipitates. At 525°C., this material swells only 1/25 as much as ordinary 316 steel after the simulated equivalent of five years in the Dounreay reactor. The testing of it in the reactor itself is yet to come, but "even now," says Dr. Nelson, "it is thought that materials like PE 16 will play an important role in the construction of fast reactors."

Fusion: The Dream Nearing Reality?

Though tomorrow's power may come from the fast fission breeder reactor (*see above*), man's next great technological triumph may be harnessing the nuclear fusion reaction.

The fusion reaction is based on deuterium—the "heavy" isotope of hydrogen; it is the "combustion" reaction that powers the stars.

The problem is to heat the fusion fuel —plasma—above its ignition point and maintain that extraordinary temperature—about 100 million degrees kinetic—long enough for the release of fusion energy to exceed the heat input. From there on the reaction should be self-sustaining, with the surplus heat available as useful power. Some fusion reactions may yield electric power by direct conversion with far higher efficiencies than through thermal systems.



Optimism that fusion power may be reality before the end of the century results from the steady improvement of plasma confinement technology. The progressive elimination of instabilities in magnetically confined hot gas has resulted at the Lawrence Radiation Laboratory in ever-closer approaches to the classical confinement goal shown by the dashed line.

Pessimism about the possibility of actually achieving the heat and pressure requirements of fusion, which has been the posture of most physicists and nuclear engineers for at least a decade, is now giving way to optimism. Indeed, recent experiments are now regarded by Dr. R. F. Post of the University of California's Lawrence Radiation Laboratory as the "immediate predecessors of what might be called 'scientific feasibility demonstrations' for fusion." Fusion, he told the National Academy of Sciences this spring, is "not necessarily a distant goal," and its achievement now begins to seem certain.

The current optimism is based on two recent experiments: Tokamak T-3 work in Moscow, in which a combination of magnetic fields was successful in concentrating the plasma at temperatures of about 10 million degrees with the gas almost as dense as the theoretically required minimum (*see* Technology Review *for January, pp. 6-7*); and work at the Lawrence Radiation Laboratory in which further improvements in temperature and plasma stability were achieved in more conventional experiments. The result is that—while Dr. Post admitted that plasma theory is a "very difficult business"—"there are more and more cases where theory and experiment agree closely, so that prediction based on theory is be-

coming more of a science and less of an art."

A large number of new plasma experiments are scheduled for 1971 and 1972. No one can be sure that any will be successful, and no one knows the answer to the crucial question: How good does plasma confinement have to be for a reactor? "We cannot assume before the fact that the present favorable trends will continue all the way to a reactor—but there are certainly strong reasons for hope," Dr. Post told the Academy; he proposed that fusion power could be a laboratory reality by the 1980's.

DEVELOPMENT

What To Do With Free Natural Gas

The oil wells of Saudi Arabia produce, as a by-product, about 2000 million cubic feet of natural gas per day. At present, no use is made of it—about 40 per cent is reinjected into the wells, and the rest is flared. This year, M.I.T.'s William W. Seifert, Professor of both Civil and Electrical Engineering, put a team of eleven students to work on the question of whether, and how, the gas could be economically used. This was the latest of Professor Seifert's annual "Special Studies in Systems Engineering." The general conclusion was that development of the presently wasted resource was worth while.

In the scheme that the students devised, most of the gas would be desulfurized and exported. The rest of it would be used within Saudi Arabia to supply electric power for a variety of purposes, particularly relating to agriculture and the processing of non-fuel minerals.

The gas contains some two per cent hydrogen sulfide and 10 per cent carbon dioxide (both figures vary, but they usually add up to a total acid content of 12 per cent). A desulfurizing plant of the required capacity would be only a little bigger than the world's present biggest, and would cost $20 million. The sale of liquefied natural gas to Japan appeared a very attractive proposition; the eastern United States would also be a profitable outlet.

Domestic uses of the gas begin with the generation of electricity and the desalting of sea-water. As to the former, the schemes envisaged would bring the electrical capacity of the east coast of Saudi Arabia to about 1000 MW. by 1980, up from 250 MW. in 1970. The team proposed scattered, small (15 or 60 MW.) gas turbines, probably imported from Europe.

The desalting technique would be a variant of the accepted multistage flash-distillation (vertical-tube evaporation M.S.F.) which gives fresh water at 49 ¢/1000 gal. 10 million gal./day would be sufficient to irrigate a four-square-mile farm on presently unused land on the west coast, near Jeddah.

At present less than 0.5 per cent of Saudi Arabia's area is under cultivation, due to the scarcity of water, and the country imports more than half of its food. The team simulated the economics of various crops, and settled on dividing their farmland between citrus fruits, tomatoes and potatoes. An associated need would be fertilizer: new plant with capacities of 360,000 tons/yr. of nitrogen (i.e., 450,000 tons/y. NH_3) and 260,000 tons/y. P_2O_5 were envisaged.

Saudi Arabia at present also imports half its requirements for cement, of which the country used a million tons in 1969. The team found that a 1.4 million-ton/y. facility, employing 850 workers, would be economically rewarding.

Other industries that would repay development, according to the M.I.T. team, include aluminum, magnesium, iron and steel. The total investment for the network of projects envisaged would be $1.6 billion, and they would employ a total of about 5000 people.

Saudi Arabia's G.N.P. will be, in the near future, only $4 billion. Whereas the widening of the nation's export base would tend to stabilize the nation's economy, the relatively massive investment might have the reverse effect, and could force a shift in exchange rates. There is also the risk of overloading the nation's construction industry, and the virtual certainty of demanding more technically trained management than is at present on hand locally. The investment "appears feasible if phased over a period of a decade." A more careful study is proposed to determine the proper phasing of the whole complex "so as not to create undesirable economic or manpower problems."

One further criticism arose when the results of the study were presented at an M.I.T. seminar in May. No attempt appeared to have been made to depart from the waste-intensive engineering conventional in the advanced countries—to make a fresh start.

RECYCLING

Mining the Dumps: The Economics . . .

"There is no doubt at all that we could mine our trash," said Dr. Stanley M. Greenfield, Assistant Administrator for Research and Monitoring, Environmental Protection Agency. "The director of the Bureau of Mines a couple of years ago observed that the average city dump contained half a dozen metals in concentrations greater than many minable ores." Dr. Greenfield was sounding the keynote at an American Chemical Society conference on "chemical technology for resource recovery", held in Washington, D.C., on three days early in June.

As the poet Lawrence Ferlinghetti suggested many years ago: Let us see the city dumps for what they are. Jerome Kretchmer, administrator of the New York City Environmental Protection Agency, has attempted to do this, with the results shown (*following page*). His paper to the A.C.S. conference pointed out that the items listed in the table make up about 40 per cent of the city's total annual solid wastes (other than from demolition), which altogether cost the city $100 million to collect and $25 million to dump. At an annual trash growth rate of nearly five per cent, "current landfill space is projected to be exhausted by 1975." Mr. Kretchmer's agency is examining a number of means of disposal, which "could cost as much as $1-2 billion in capital expenditures and (still leave) a disposal gap of 63 million tons over the next decade and a half."

To lessen the burden, Mr. Kretchmer envisages local recycling industries. "A plant to clean, shred, melt down and remold aluminum would have no highly specialised siting requirements," he writes, adding that "only 2,000 kWh. of electricity are needed to recycle a ton of aluminum cans, compared with 17,000 kWh. per ton of aluminum made from virgin ore." Another possible city industry, he considers, is the recycling of glass. The setting up of such industries would to some extent ease the city's unemployment-and-welfare troubles.

The obstacles to the growth of resource recycling (which has always been practiced in some industries) are partly technical—for example, it would be useful to be able to sort green glass automatically from amber glass—partly economic, partly political. At the city level of government, Mr. Kretchmer's agency has generated a number of recommendations, working in cooperation with other departments. One is a Department of Purchase specification for the buying of paper, demanding a minimum of 20 per cent recycled content. Another is a Recycling Incentive Tax, designed to penalize unnecessary packaging (and provide funds for refuse disposal) while coming down less heavily on users of recycled materials. The Agency is also "looking into institutional biases, such as freight rates and hauling provisions, as well as discriminatory tax, capital gains or depreciation policies that favor virgin materials over reprocessed ones and thus discourage the growth of a recycling industry."

The last point applies equally on the national level, as many speakers at the conference agreed. M. J. Mighdoll, Executive Vice President of the National Association of Secondary Material Industries, when asked what kind of incentives he proposed for the encouragement of the re-use of materials, said that he was asking not for any kind of preferential treatment, but merely for recycled materials to be placed on a par with new resources, as regards taxa-

	Tons (approx.)	Current dealer's scrap value per ton (varies widely)	Total estimated scrap value
Aluminum cans	12,000	$200	$2,400,000
Steel (from tin-free cans)	23,000	10	230,000
Steel (from detinning and remaining bimetal containers)	169,000	3	507,000
Glass containers	348,000	17	5,920,000
Newspapers	500,000	17	8,500,000
Paper (corrugated and folding containers of all types)	1,480,000	10	14,800,000
Subtotal	2,532,000		$32,357,000
Abandoned cars	100,000	15-20	$1.5-2.0 million
Total	2,632,000		(Approximate) $34,000,000

Estimated value of scrap in New York City's municipal solid wastes, per year (J. Kretchmer and C. B. Harris)

tion, transport charges, and the attitudes of users. The Institute of Scrap Iron and Steel, Inc., is currently investigating the economic consequences of the present system of depletion allowances, to discover just how much difference these entrenched incentives make to the amount of scrap metal used by iron and steel manufacturers. (*For more on scrap iron, see below.*)

The Technology . . .

But back to the city dump, viewing it this time on the federal scale: "We are currently following the ridiculous practice," said Max J. Spendlove, who is director of the Bureau of Mines' Metallurgy Research Center at College Park, Maryland, "of paying $3.5 billion annually to destroy 112 million tons of paper and plastics, 16 million tons of glass, and 14 million tons of metal, most of which might well be recovered simply by applying available equipment and technology."

Mr. Spendlove described a demonstrated process, using conventional mineral-extraction methods, for extracting metals and glass from the residues of municipal incinerators (*see diagram*). A point of interest is the glass, which Mr. Spendlove described as "suitable for recycling to manufacturing plants." Colored is separated from clear glass magnetically, on the basis of iron content. A ton of residue produces an output valued at $15.76 in all, at a processing cost of $4.06 (based on a 20-year amortization of the 250-ton/day plant). If the raw material is assumed to be free (a conservative estimate, since the value of municipal incinerator residues is, if anything, negative), the difference is pure profit.

The Bureau is now beginning similar work on *un*incinerated refuse.

And the Steelworks

The steel-industry side of the question was presented by William S. Story, Executive Vice President of the Institute of Scrap Iron and Steel, Inc. He provided one rather surprising set of numbers: in 1956, the U.S. steel industry produced 115 million tons of steel, using in the process 29 million tons of purchased scrap. Today (1970 figures) the output is 132 million tons a year, and the consumption of scrap is still 29 million tons. So the gap between the manufacture of steel and its recycling is actually growing, in spite of the fact that the reuse of a ton of iron and steel scrap saves a ton of coal, a ton and a half of ore, and half a ton of limestone.

This gap is embodied in, mainly, "those items which today constitute the biggest headache in terms of metallic solid waste—the old car, the refrigerator, the stove, the washing machine and the ubiquitous tin can." (This "obsolescence" scrap is one of two classes of scrap which may be purchased by steelmakers, the other being industrial scrap from fabrication plants; there is a third class of scrap, "revert," generated and reused within the steel mills and foundries themselves.)

There are two reasons for the growing non-use of junked steel products. One is that they tend to be complex, containing many inconvenient materials which are hard to remove. The other is that in the 1950's, in an attempt to catch up with European technical advances, U.S. steelmakers adopted the basic-oxygen process, whose intake cannot contain more than 27 per cent scrap (whereas the open-hearth process can use 45 to 50 per cent).

The growing number of small steelmakers using neither of these methods, but instead using an electrically-heated system which can take in 100 per cent scrap, offers some hope for the future, said Mr. Story—except that in this case, scrap is meeting competition from an iron-ore product, the metallized pellet.

"The ferrous scrap processing industry," said Mr. Story, "today has the capacity to handle all of the scrap which is generated in this nation. But we need larger markets. This means the steel industry needs to be encouraged to use more scrap, especially from obsolescent sources."

What form this encouragement might take—apart from the egalitarian measures mentioned above—is not yet entirely clear. In the discussion following Mr. Story's paper it became evident that one sturdy bulwark of the status quo is the fact that the people who make steel are also in the business of mining iron ore. They have not been in the business of mining the nation's junk-heaps. (However, since the conference a group of major steelmakers have announced a can-collection program similar to that of the aluminum companies.)

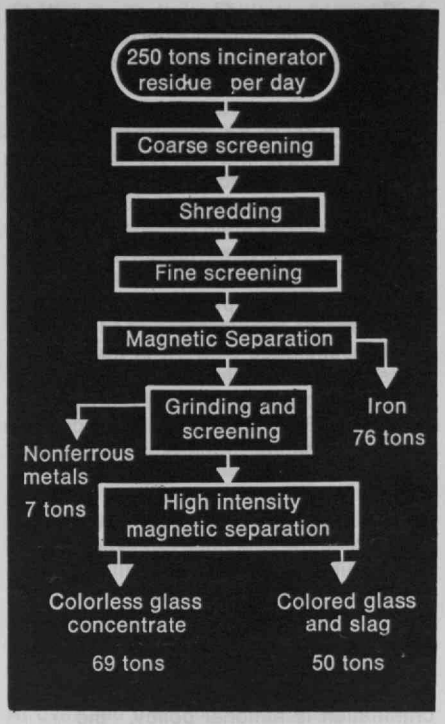
METEOROLOGY

Climate Is International

Climate knows no national boundaries. But can there be an international consensus on the responsibilities of nations to preserve the finely tuned balances on which our climate depends?

A new study of man's possible global and regional effects on Earth's climate is now in progress near Stockholm, Sweden, under sponsorship of the Massachusetts Institute of Technology. International in scope, the Study of Man's Impact on Climate (S.M.I.C.) is building on M.I.T.'s 1970 summer Study of Critical Environmental Problems (S.C.E.P.) to review and extend its results (*see* Technology Review *for October/November, 1970, pp. 58-59).*

Conference members include distinguished scientists from Australia, Belgium, Canada, Denmark, England, France, Germany, Hungary, India, Israel, Italy, Japan, Sweden, and the U.S. Carroll L. Wilson, Professor of Management at M.I.T. who directed the S.C.E.P.



A recently announced process for the reclamation of materials from incinerated municipal solid wastes gives products valued at over $15 per ton, at an operating cost of $4 per ton—or, for a larger plant, considerably less (Max. J. Spendlove after P. M. Sullivan and M. H. Stanczick, Bureau of Mines Technical Progress Report No. 33, April 1971).

study, is also Director of S.M.I.C., and William H. Matthews, Assistant Professor of Civil Engineering, is Associate Director.

The S.M.I.C. conference (June 28 through July 16) has been encouraged by the Secretary-General of the Conference on the Human Environment, to be held by the United Nations in Stockholm in 1972, and Professor Wilson said before leaving for Stockholm he hopes that the "international scientific consensus on what we know and don't know and how to fill the gaps" to be developed at S.M.I.C. will provide a foundation for action at the U.N. meeting.

"Of particular importance to those of us meeting in Sweden will be to identify those questions which ultimately will require international policy decisions by nations," he said.

Participants in last summer's S.C.E.P. concluded that carbon dioxide—though produced in large quantities in the consumption of fossil fuels—and the corresponding depletion of atmospheric oxygen—represented little threat to climatic stability in the current century. But the effects of particulates and of other gases on the atmosphere are little known. As a result, S.C.E.P. recommended a program for atmospheric monitoring, and intensive research on inadvertent climate modifications that might be caused by man (*see "Global Environmental Monitoring," by George D. Robinson in* Technology Review *for May, 1971, pp. 18-27*).

The same issues are now being reopened at S.M.I.C., whose participants are considering the possible climatic effects of carbon dioxide, particulates, and other combustion products as well as water vapor and heat.

"The consequences and implications of any remedial action to alleviate environmental problems which might be caused by build-up of such products in the atmosphere are so profound that it is highly desirable to obtain an international consensus on the nature of these effects at the earliest possible time," Professor Wilson wrote in his prospectus for S.M.I.C.

Financial support for S.M.I.C. has been provided by grants from the National Science Foundation through its program of Research Applied to National Needs (R.A.N.N.), the American Conservation Association, and the Ford and Sloan Foundations. S.M.I.C.'s hosts include the Royal Swedish Academies of Sciences and Engineering Sciences, and S.M.I.C. has been encouraged by the Special Committee on the Problems of the Environment of the International Council of Scientific Unions, the Joint Organizing Committee of the Global Atmospheric Research Program, and the World Meteorological Organization.

INTERNATIONAL STUDIES

Daniel Ellsberg's Stalemate Machine

Until six weeks ago, Daniel Ellsburg—a Senior Research Associate in M.I.T.'s Center for International Studies—was known to but a few close colleagues and to essentially no students. He might have been—but wasn't—the Center's "Exhibit A" when M.I.T.'s few S.D.S. members noisily challenged C.I.S. last spring as the "architect of American military colonialism."

No one on the campus admits to any premonition that Dr. Ellsberg was to precipitate a crisis from which would come a new interpretation of the relationship of press and government in the U.S.—or that he could be charged with unauthorized possession of classified documents.

But members of the American Political Science Association who listened attentively to Dr. Ellsberg's paper at the Association's annual meeting in September, 1970, and careful readers of *Public Policy* magazine, where the same paper appeared in somewhat abridged form in May, 1971, might have had a hint of what was to come.

Dr. Ellsberg's basic thesis in both documents—the *Public Policy* paper is entitled "The Quagmire Myth and the Stalemate Machine"—is that U.S. policy in Vietnam was not developed in response to an uncontrollable, increasing involvement in a Southeast Asia quagmire. It was, rather, the result of decisions motivated largely by domestic political issues which the administrations involved could not or did not choose to discuss realistically in public.

"Rule 1 of the game," he wrote, "is: 'Do not lose the rest of Vietnam to Communist control before the next election.' And Rule 2 is, 'Do not commit U.S. ground troops to a land war in Asia, either.' " Hence, the "Stalemate Machine."

Clearly this cloak of secrecy, which in effect made Vietnam decisions appear to be based on one set of issues when in fact they were based on another, deeply troubled Dr. Ellsberg. "What seemed clear as one listened to speeches, or observed official actions, or compared the two, is less so when files are opened and concealed actions, official estimates, and internal arguments emerge. Under the magnifying lens, previously evident patterns . . . dissolve like the canals on Mars," he wrote in *Public Policy*.

Daniel Ellsberg is not alone in his concern for the lack of public participation in government. Commenting to a group of alumni in New York in June on the increasingly sophisticated issues with which government deals, M.I.T. President Jerome B. Wiesner made the same point: "If we want to run a democracy," he said, "we must find a way for the people to know what is being done in their own names."

Dr. Ellsberg came to M.I.T. in April, 1970, specifically to study the development of American foreign policy in times of crisis. His work was to use as cases American relations with Cuba, the Dominican Republic and Vietnam—and possibly Korea and Guatemala as well. The result would presumably be a scholarly book—and perhaps ultimately, according to Everett E. Hagen, Director of the Center, a new thrust into the field of modern American foreign policy for the C.I.S. Dr. Ellsberg's research appointment was renewed in April, 1971, and changed at his request from a full- to a half-time basis.

As this issue of *Technology Review* goes to press, M.I.T. simply considers Dr. Ellsberg "on vacation" (he is entitled to four weeks' annual leave). Dr. Ellsberg has no teaching responsibilities, and the Institute has a long-standing policy of taking no action which could be prejudicial to judgements yet to be rendered in civil or criminal proceedings.

A Stockholder's Responsibilities

The Massachusetts Institute of Technology voted its 202,960 shares of General Motors Corp. stock in accordance with the recommendations of G.M.'s management—against the several stockholder proposals—at G.M.'s annual meeting this spring. But it did so only after appointing—and consulting with—a special subcommittee of the Executive Committee of the M.I.T. Corporation whose assignment is "to deal with ways that M.I.T. may respond to issues involving social responsibilities of business concerns of which M.I.T. is a shareholder."

And, said President Howard W. Johnson, M.I.T. independently informed the General Motors management of the Institute's continuing concern with issues involving public policies and social responsibilities of business concerns in which the M.I.T. is a shareholder. The Institute, he said, expressed itself as sympathetic to the concept that there should be additional means for making nominations to companies' boards of directors. But it was not convinced of the soundness of any of the stockholder proposals presented to the G.M. meeting.

Responsibilities as Shareholder

Creation of the subcommittee on the Institute's responsibilities as shareholder was recommended by three members of the M.I.T. Corporation asked last winter by their colleagues to study how the Institute should respond on corporate proxy matters: Vannevar Bush, Honorary Chairman of the Corporation; James A. Champy, a Lawrence, Mass., attorney; and William B. Murphy, President of Campbell Soup Co. Acting on their recommendations, President Johnson this spring named Dr. George W. Thorn, Physician-in-Chief at Peter Bent Brigham Hospital; Carl M. Mueller, Partner in Loeb, Rhoades and Co.; and Jeptha H. Wade, Partner in Choate, Hall and Stewart of Boston, to the subcommittee.

The subcommittee's long-range assignment, President Johnson said, was to perfect an institutional policy on social issues that face stockholders, to make recommendations on the basis of that policy, and to provide a focus for community discussion of the issues involved.

The study group anticipated two kinds of questions on which the Institute should in the future be prepared to act: those affecting companies "which are not fully aware of their obligations to act in the public interest or who deliberately do not intend to do so"; and those proposing election of directors designated to represent the "public" or other specific interests.

In the first case, the study group said, "it is entirely legitimate for a group to attempt correction through the mechanism of stockholder voting; and if M.I.T. is a stockholder, it can hardly avoid the issue when it occurs."

The second case seemed far less clear. "We have an open mind at the present time on the question of whether greater participation by stockholders in the selection of directors would produce favorable results," wrote the study group. "If companies are genuinely anxious to improve the quality of their boards, no such change should be needed. If they are not, we fear a change might produce confusion rather than betterment." Each case must therefore be considered separately.

In fulfilling these recommendations, said the study committee, M.I.T. must not be drawn into trivial debates, and these suggestions do not apply to proxy fights through which some group is attempting to seize control of a company.

But M.I.T. must not fail to act, and it must not sell its stock in a company simply because that company disregards what the Institute sees as the public welfare. "Certainly the ability of management is a very important point to consider in all investment decisions," the study group wrote. "Certainly also, a disregard of the public welfare is an indication that management is lacking in judgment. But to sell stock, when the only point involved is social responsibility, is merely to avoid the issue."

The study group also noted that public responsibility can be expressed in ways other than on annual-meeting proxy votes. For example, the study group foresaw the possibility that the form but not the purpose of a resolution might seem inappropriate. In such a case, said the study group, M.I.T. "might want to vote against the resolution but simultaneously to impress upon the company management forcibly that steps should be taken to meet the objective." This was, in fact, M.I.T.'s response on several of the proxy issues before the 1970 General Motors Corp. annual meeting more than a year ago, and the same response was made in May, 1971.

The newly created subcommittee will make its headquarters in the office of Walter L. Milne, Assistant to the Chairman of the Corporation, and it has arranged for a special study of corporate "democracy," public policy, and social responsibility to be directed by Edward H. Bowman, Professor of Management at M.I.T.

Stockholder Participation

In an initial statement this spring, the subcommittee presented six recommendations as a kind of progress report of its deliberations:

◇ The subcommittee agreed with the study group on M.I.T.'s obligations to respond on issues of public policy and social responsibility.

◇ The subcommittee went on record as favoring the appointment of corporate committees on public policy.

◇ Though membership on boards of directors should be diversified, the subcommittee does not believe that naming to boards of directors representatives of such specific constituencies as consumers, minorities, or labor "is in the interest of effective corporate activity."

◇ New means for proposing nominees for boards of directors are needed, but the subcommittee said "it is not convinced of the soundness of any of the current resolutions it has reviewed" on this topic. But "shareholder participation in the nominating process . . . deserves further study."

◇ Corporations should find new ways of better informing their stockholders about public policy and social responsibility, the subcommittee said.

◇ Though the subcommittee is "deeply concerned" about U.S. corporations operating in areas where racial discrimination is national policy, "the present situation is not well enough understood to warrant support of specific proposals for withdrawal," its report said.

A Harvard View

Responding to the question of an institution's responsibility as corporate stockholder (*see above*), Harvard University was asked late this winter by a committee of senior faculty to name an officer to act as "fact-finder" regarding "the non-financial aspects of the University's role as investor."

Seven members of the Harvard faculty, reporting as the Committee on University Relations with Corporate Enterprise, said Harvard must first "strive fundamentally for maximum return" on its investment when it goes into the equity market. But in some kinds of investments, and in some situations, the University "cannot close its eyes to the moral factors," the faculty group said. The University "may properly, and sometimes should, attempt to influence management in directions that are considered to be socially desirable." But its obligations do not extend to initiating actions concerning companies which may be operating in antisocial ways, or to organizing other public institutions to do so.

"It is no answer that Harvard's investment would not be big enough to give it an influential voice in corporate decisions," wrote the Harvard committee chaired by Professor Robert W. Austin of the Graduate School of Business Administration. "Certainly the University should vote its stock on occasion in favor of change for the symbolic effect of a great university's taking a position on a social problem."

Gifts and Grants: the Growth Rate Falters

Private gifts and grants to all U.S. colleges and universities were $1.78 billion in 1969-70—down from $1.8 billion in 1968-69—according to estimates of the Council for Financial Aid to Education. The 1.1 per cent decrease is the first recorded since 1957-58; it ends a decade-long growth trend which has averaged 9 per cent a year, according to C.F.A.E.'s annual report on voluntary support of education in 1969-70 published late this spring.

The Massachusetts Institute of Technology, reporting 1969-70 gifts and grants of just under $20 million, stands 14th in the C.F.A.E.'s ranking of U.S. institutions by total receipts. Harvard (over $52 million) is at the top of the year's list, followed by New York University, the University of Chicago, the University of Texas system, and Yale University.

At over 800 institutions reporting in both 1969-69 and 1969-70, alumni support was just under 25 per cent of the total of gifts and grants; the total alumni support of just over $300 million in 1969-70 was nearly 12 per cent lower than in 1968-69. Foundation and non-alumni individual support (both also about 25 per cent of total giving) also declined in 1969-70; business support (about 15 per cent of the total) remained essentially constant.

M.I.T. appears in eighth place in what the American Council—cooperating with C.F.A.E. in the project—calls the "top ten honor roll" in the number of donors to the annual Alumni Fund, and the Institute's 20,461 alumni donors in 1969-70 place it sixth among major private universities. (M.I.T.'s 1970-71 Alumni Fund, just closing its books as this issue of the Review went to press, had already surpassed by a slight margin the 1969-70 Fund in both number of donors and total of gifts. The 1969-70 Fund had fallen short of a new record in total giving while setting a new high in the number of donors.)

Every group of donors to major universities in 1969-70 contributed more for current operations, and less for capital purposes, than in the previous year. M.I.T. told the Council that $13.5 million of its 1969-70 gifts and grants were for current operations, less than $6.2 million for capital purposes.

Of M.I.T.'s total gifts and grants reported to C.F.A.E., $6.7 million came from business, $5 million from foundations, $5 million from alumni, and $2.7 million from non-alumni individual donors.

Salaries: Losing the Battle with Prices

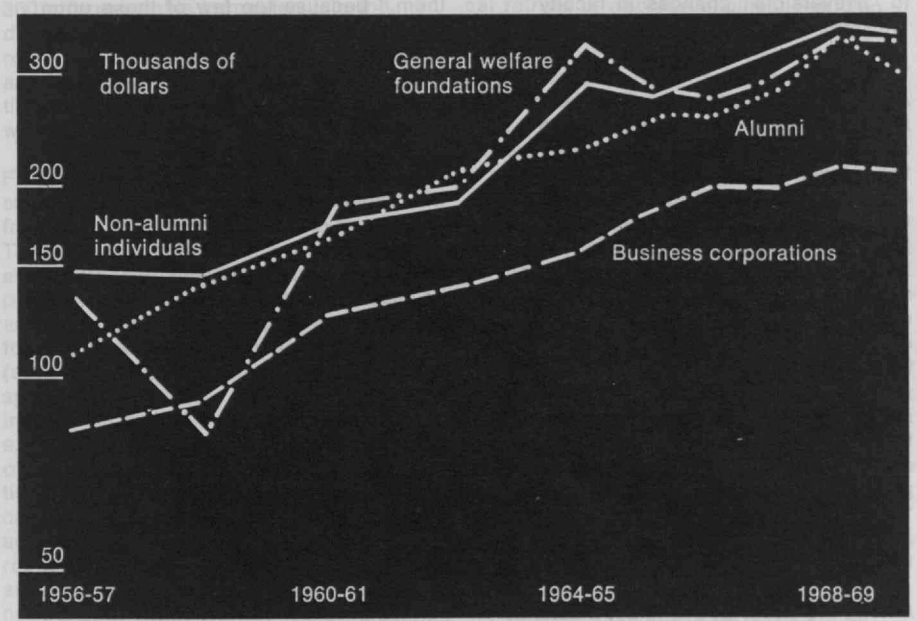
"At the Brink" is the ominous title given to its 1970-71 report on professorial salaries by the American Association of University Professors. Though M.I.T. rates 16th among all U.S. colleges and universities in its compensation of teachers in all ranks in 1970-71, the A.A.U.P. report makes it clear that inflation is an unwelcome guest in almost every faculty household. Indeed, says the A.A.U.P., the average of faculty salaries was "scandalously small" in terms of real purchasing power. Teachers are in danger of becoming "the main source of subsidy to higher education" because compensation is rising too slowly.

The chief villain is inflation, as recorded by the U.S. Consumer Price Index. In 1964-65, the average annual salary increase for professors was slightly more than seven per cent; the Consumer Price Index rise ate up 1.4 per cent of this and professors were left, on the average, with about a six per cent rise in real purchasing power. But in 1969-70, the average faculty salary increase was less than at any time since 1964—about 6.2 percent—and today's higher cost of living ate up fully six per cent of this, leaving the professors little if any better off *(see chart on page 62).*

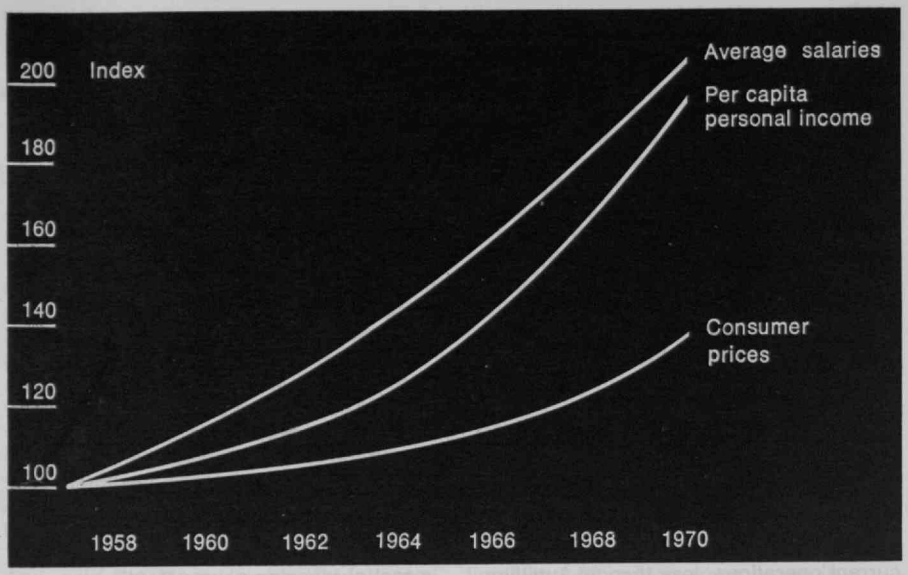
For many there was actually a net loss, says the A.A.U.P. Between the school years 1964-65 and 1965-66 the number of colleges and universities who gave salary increases that were less than the cost of living increase for the period was less than 10 per cent. There has since been a steady increase in the numbers of such institutions until, between 1969-70 and 1970-71, their numbers had swelled to over 50 per cent.

Average compensation in dollars, salary plus fringe benefits, varies widely depending on the type of institution from the large university offering the most advanced studies and degrees to the small two-year junior college. Across this spectrum, the average compensation for professors varies in 1970-71 from $25,740 to $13,530; associate professors from $17,990 to $12,270; assistant professors from $14,550 to $10,810; and instructors from $11,460 to $9,250. M.I.T.'s averages, according to the A.A.U.P., are $25,900 for professors, $17,100 for associate professors, $13,900 for assistant professors, and $11,500 for instructors.

Seventeen institutions reported average compensation for full-time faculty above $17,000 for 1970-71, medical schools excluded. Six of the 17 are units of the City University of New York; M.I.T. ranks 16th in this group. M.I.T.'s average compensation for full-time faculty is reported at $20,000. Above the Institute, in addition to the various C.U.N.Y. units, are the Claremont Graduate School, Harvard University, California Institute of Technology, New School for Social Research, Stanford University, Yeshiva University—Graduate School, University of Chicago, Hebrew Union, and Yale University.



After a decade of gradual but steady increase, voluntary giving to U.S. colleges and universities faltered in 1969-70. The Council on Financial Aid to Education estimates the total at $1.78 billion, the second highest on record, down 1.1 per cent from 1968-69. M.I.T., with gifts and grants of just under $20 million, ranked 14th among institutions surveyed by C.F.A.E. in terms of total gifts; but the Institute ranked sixth among major private universities in its number of graduates giving to the annual Alumni Fund.



A decade ago average faculty salaries in the U.S. were making good progress in comparison with average U.S. incomes and the Consumer Price Index. But in 1970-71, says the American Association of University Professors, salary increases were smaller and price rises larger; the two were in fact balanced and the average professor was little if any better off. (Chart: A.A.U.P. Preliminary Report on the Economic Status of the Profession, 1970-71)

The Changing Professorial Life

Inflation and its side effects *(see above)* coupled with a few other contemporary social forces, may very well dispose of the traditional stereotype of academic life during the next decade. That is the judgment of Robert T. Blackburn, Professor of Higher Education at the University of Michigan, in research published this spring by the American Association for Higher Education.

The forces now affecting college and university faculties "reside almost exclusively outside the professor's control. He is a part of a revolution he cannot manage. He must undertake major readjustments in order to endure and to flourish," writes Professor Blackburn.

The four influences Professor Blackburn chooses to prove his point are:

◇ *Economic Forces.* Salary problems are only a part of a larger economic swing away from support for colleges and universities. Major changes in their methods and perhaps in their influence are almost inescapable.

◇ *Unionization.* As a social force, unionization is having and will continue to have "important consequences for faculty behavior." University employees—including faculties at some institutions—have been fighting successfully for a larger share of available salary money and "Nonorganized faculty are realizing they are getting what is left over after all others have had their bite."

◇ *Ph.D. Supply.* Ph.D.'s are now "flooding the market" because of increased graduate school production and because of fewer nonacademic and academic jobs. He concludes that the trend will continue: "Both the short-and long-run need for Ph.D.'s in colleges and universities will appreciably diminish," making pursuit of academic careers "riskier" in the future.

◇ *Moral Revolution.* Perhaps most portentous for the future is that value systems are changing. Truth is being placed above loyalty; the individual above the organization; human needs over technological concerns; personal expression above social forms; openness over secrecy. These, says Dr. Blackburn are forces which will lead to "irreversible" changes in faculty life style.

The Results

Among the consequences Dr. Blackburn sees for faculty and potential faculty members are these: Openings for new faculty will be few and far between; faculty mobility will drop sharply; judgments made on awarding tenure will become more severe; the number of teaching fellows will go down and the number of regular faculty teaching undergraduates will go up; unionization of faculties will accelerate to "a revolutionary pace," resulting in a smaller voice and less participation for students in the running of the university; student faculty relationships will take on a new character; ways of measuring faculty performance will be given a hard look: "productivity" will be more carefully and perhaps very differently defined than in the past.

Among the positive results Dr. Blackburn expects to see evolve from all this are: a reevaluation of their role by faculty—"a healthy activity;" increased faculty influence on the allocation of resources; increased openness of all parties in the educational process; and a rise in the faculty talent level because of oversupply—"The have-nots will more closely approach the haves," he says.

Care and Flowering of Institutions

In the season of commencement addresses about lofty purpose and new horizons, President Howard W. Johnson of M.I.T. brought a message of warning very close to home. All our social institutions, he told the Institute's 1,200 graduates on June 4, are simply now "inadequate to meet our needs in them," because too few of those upon whom they could depend for strength and quality feel a commitment to their needs.

Speaking to the graduates, President Johnson insisted that "the future of these institutions—and of the world—will depend on . . . personal caring on the part of each of you."

"Institutions are seen as instruments to be used and exploited," said President Johnson, and the result is just as corrupting to an institution as to an individual: challenges are by-passed and goals are set too low.

In this very way, Mr. Johnson told the graduates, "universities . . . fall far short of the quality of institutions they might be because too few people, among their several constituencies, really care.

"To many observers," said President Johnson, "the university today appears to be the most fragile, most troubled, and least certain of its goals among all institutions. . . . It is assumed by some that only a few—some administrators, some faculty, some students, some trustees—have the burden of sustaining the institution, while everybody else, to some extent, uses it." But in fact, Mr. Johnson said, "every person who thinks of himself as responsible must care for every institution he touches."

Taking the Institute as his example,

President Johnson declared: "I am convinced that the quality of what M.I.T. has achieved in the past, and still is achieving, will not endure unless a substantially greater number in all of its constituencies examine their own roles and shift more of their involvement from using to caring.

"And I mean faculty, staff, students, alumni, Corporation, and administration," said Mr. Johnson pointedly.

Plant Inventory

"Print spaces assigned to materials research."

"Take off floor area assigned to room type 'office'."

Both of these are possible commands to "Insite II," a computerized institutional space inventory system developed for studies of M.I.T.'s academic plant by the Institute's Planning Office. Kreon L. Cyros, the project director, thinks it will be a useful tool for nonacademic management as well, when they need to weigh the merits of competing demands for limited space and to obtain data on which to plan future facilities.

"Insite II" consists of a special language, appropriate programs, and a data bank operating under the M.I.T.-developed "ICES" (integrated civil engineering system) framework in an I.B.M. System/360 or comparable computer. Into the data bank go the dimensions of each room, its uses, maintenance status, and whatever other special characteristics the system's users expect to work with.

From it can come answers to questions such as those above, which are in fact framed in "Insite II's" own language. The system can yield such traditional answers as the number of square feet per occupant in various activities, the amount and character of spaces assigned to departments and groups, the ranks (assistant professor, etc.) of particular space occupants, the spaces assigned in relation to the kinds of activities expected in them, and even an inventory of spaces with particular characteristics—wall materials, temperature controls, exterior and interior access, adjacent spaces, or whatever. The routines also make possible tri-level answers—for example, a tableau of net assignable square feet by building, by assigned user, and by room type.

One less obvious application of "Insite II" is in building maintenance: What space now used as an office has been longest without fresh paint? How many laboratories, animal rooms, and offices will a janitor have to serve if he is given a particular section of a particular building?

Indeed, Mr. Cyros proposes that "Insite II" is comprehensive and flexible enough to serve "as a model of the physical plant for any institution." To test this proposal, he is studying various alternatives for sharing with other universities both the system and the methodology for making the best use of it as a planning and management tool.

TRANSPORTATION

For Quieter Airports

Idlewild was built on a swamp, surrounded by open land. By the time its name became JFK, development had shuffled up to the airport's bounds, the airport's noise had become a behemoth presence, and development and noise combined to squeeze a lot of humble citizens. The remedies are expensive and few: land-use planning, which could have begun as the swamp was drained, or acoustical retrofit of aircraft engines.

The area around JFK where noise makes homes uninhabitable could be redeveloped for compatible industry—at a cost of $600 million just for property acquisition and clearing. Sound-proofing for buildings in areas of lesser sound intensity would cost another $700 million. The land would absorb all the industrial development anticipated for Brooklyn, Queens, and Nassau for the next 20 years.

Another way of reading the economics is a bill recently introduced by Sen. Alan Cranston of California to require acoustical retrofit of airplane engines, reducing the noise at its source, by Jan. 1, 1976. The bill allots $1 billion, of which $35 million would support research into the design of retrofit equipment. It would cost from $600,000 to $1 million to retrofit each plane that needs it; noise from the craft would be required to drop by about 10 PNdB (perceived noise decibels—sound is measured on a logarithmic scale, and a 10PNdB difference is perceived as a factor of two in loudness.) The bill adds heat to a subject already hotly debated: whether the cost of retrofit can be justified.

Each generation of aircraft engines has been more powerful and less noisy than the last. Thus, the first low-bypass-ratio turbofan, the Pratt and Whitney JT3D, replaced the turbojet JT3C on new four-engine 707's and DC-8's several years ago, and dropped their approach noise by 15 PNdB. Much of the decrease came from lessening the exhaust roar by mixing bypassed air with it as it left the engine. Some of the whine from the fans was modified in later versions of the JT3D.

The JT8D came next, another low-bypass ratio turbofan, to power the two- and three-engine 727's and 737's. A lot of work showed, mostly, that it would be harder to improve the sound from this engine than from the JT3D. The fan noise was dropped a bit.

The JT9D, a high bypass-ratio-turbofan, lifts the new wide-bodied jets, the 747's and DC-10's. It is substantially different in design from its forbears. Because it sweeps much more air past the engine to dilute the exhaust, and because its fan is much improved, the JT9D is a quieter engine. It meets the newest F.A.A. noise requirements.

The JT9D, then, is a quiet engine; it is also a big engine, and cannot fit on to smaller existing jets. To develop a smaller version would take perhaps five years. N.A.S.A. is working on a quiet engine; theirs will be more than five years reaching fruition, and success is not guaranteed. The remaining alternative is Senator Cranston's—acoustical retrofit.

The JT9D carries a good deal of padding to damp down noise from its machinery, and such padding can be designed for the other engines. Modifications of the engine design can sometimes cut down engine whine, or change its tone, without decreasing the efficiency or thrust of the engine. The other source of noise, the exhaust roar, is much more obdurate. Suppressors that fit behind the exhaust opening have been built in configurations of 6, 10, 19, and 48 lobes, among others; but none could be found that would reduce the most bothersome frequencies of sound without hampering the engine's thrust.

This is the kind of research that the bill would support. The $35 million would allow the $5 million needed for developing equipment for each of 7 or 8 airplane types. The remaining funds, supported by a 1.5 per cent fare increase, would pay for the actual retrofit. Some 35,000 jobs would result.

As to whether or not the program would prove cost-effective: in 1965, some 550,000 people lived within a noise contour around J.F.K. deemed highly unpleasant. 60,000 of them were in a zone of intolerable noise. The contours are defined in Noise Exposure Forecast (N.E.F.) units, a measure that balances the noise from each flight with factors such as frequency of noise and time of day. An N.E.F. of 30 or above is not recommended for new residential construction, and for old buildings in such a zone sound insulation is recommended. N.E.F. 40 or above is recommended only for industrial use.

By 1975, the N.E.F.-30 contour is expected to be of a size (in the absence of retrofitting) to contain 510,000 people, and the N.E.F.-40 contour 50,000, living on 54 and 15 square miles of land respectively. Merely modifying operating procedures (changing angle and direction of approaches and take-offs, for example) could add 1.9 per cent to the land area within the 1965 N.E.F. 30 level and remove 5.5 per cent from the N.E.F. 40 level. Acoustical padding in the engine case would reduce the N.E.F.-30 area to 68.7 per cent of the 1965 size and the N.E.F.-40 contour to 64.1 per cent. Acoustical retrofit would decrease by 60 per cent the above-mentioned $1.3 billion tab for restoring compatible land use

around J.F.K.

Although no one knows how much noise does what to whom, there is evidence that it is not especially beneficial. Alexander Cohen, of H.E.W., reported to a Society of Automotive Engineers/D.o.T. conference on the aircraft and the environment last winter that airport noise "can affect states of social and mental well-being through masking speech communication or other desired sounds, disrupting behavior and subjective feelings, and interfering with one's need for privacy, rest, and sleep." The problem of noise in one's home is aggravated for those who must also work with loud or sustained noise. The Walsh-Healey Act established permitted exposures to noise on the job, but its tolerances were predicted upon a quiet home for recuperation.

Mr. Cohen cited a Russian experiment showing that one hour's exposure to the equivalent of 10 overflights at 90 dBA each (dBA measures actual noise, whereas PNdB or EPNdB are measures of perceived noise) produced in young laboratory animals "significant changes in central nervous system functions," "inhibitions of reflexive or conditioned reactions," and "notable vasoconstrictive changes." The Russians recommended levels of 85 dBA in the daytime and 75 dBA at night, regardless of frequency of flight.

One suggestion made at that conference was that the aviation industry make a greater attempt to inform the public of practices and changes that do cut down on noise; roughly, a halving of noise is needed before the public will perceive it.

Aero-Engineering Still Interesting

Professor James W. Mar, presently *in absentia* from the M.I.T. campus as Chief Scientist of the U.S. Air Force, recently returned to address the Institute's Aero- and Astronautics Department on the question of what kind of attractions the field of aerospace engineering can offer its young aspirants these days.

He began by presenting a colleague's version of the current depressing statistics and predictions on aerospace employment and funding. Was there any rational basis for the predictions, asked Professor Emeritus Jerome C. Hunsaker? They were based, said Professor Mar, on estimations of the national mood. "You mean," said Professor Hunsaker, "the press, television, all the hullabaloo?"

Well, yes. But in any case, Professor Mar's feeling was that statistics on the growth or shrinkage of the industry might not be the proper framework upon which to base one's advice to students. He did not recall, when he himself first entered the field, being swayed by such graphs. What had attracted him was the technical interest of the work, which presented problems quite different from those found in the more earthbound varieties of engineering. And this, he thought, was still the case.

Over the years, aircraft structural design had undergone changes of emphasis. Initially, the designer was concerned only with the static strength of his structures, and could allow generous safety margins. Then came the business of designing for "flutter", which meant making exact predictions of stiffness rather than simply ensuring that Then the Comet failure brought fatigue into the picture, and it became necessary to pay much more attention to detail, and to demand a new level of complexity in manufacturing processes.

The outcome, so far, is that today's aircraft have smaller factors of safety than those of 10 to 15 years ago. Structural failures can be caused by smaller cracks, subjected to smaller fractions of the yield stress, than hitherto. A fatal crack may easily go unnoticed during any practicable inspection.

So the next step is for the designer to be realistic about the capabilities of manufacturers' inspectors. This could be done by taking the minimum practically detectable crack length as a "given", and designing so that stresses will not arise which would cause a crack of that size to grow. Unfortunately, said Professor Mar, it is not yet possible to combine such an approach with the overriding effort to minimize weight.

So, in one way, aero-engineering is still as it was—a field where the technical tasks are quite different from those in any other.

On Designing Design

Inflation in the cost of technology is nothing new under the sun, but in the procurement of naval vessels the problem of rising prices is less a matter of rising cost than of rising technology.

Today's naval ships may not look very different from those built a decade ago, but the similarities end with the hulls, Captain Sherman C. Reed, Director of the Ship Concept Design Division of the U.S. Navy Ship Engineering Center, told an M.I.T. seminar this spring. The fact is that weapons and propulsion systems—and, indeed, everything which increases the price while it increases effectiveness—are packed more tightly into ships than ever before. Quoting figures assembled by Lt. Clark Graham, U.S.N., of the Ship Engineering Center, Captain Reed said that in ten years the average naval vessel's electric power requirement has doubled. Air conditioning demand has tripled. The electronics shopping list—the number of items to be procured for a new ship—is now three times as long as a decade ago. Environmental standards have increased, too: the Navy now plans on 50 per cent more space per man than ten years ago.

One measure of the increasing sophistication: the documentation involved in contracting a new ship has multiplied 15 times in a decade.

But the real headaches are yet to come, said Captain Reed, with the advent in the fleet of such exotic vessels as catamarans, air-cushion vehicles, hydrofoils, hinged ships, and high-performance hulls. Here design problems multiply as labyrinths of new, interlocking systems are required. For example: it is easy to cool conventional ships by circulating sea water, but what about an air-cushion vehicle?

Under the kind of complexity which he described, said Captain Reed, the man who holds the key to shipbuilding may not be the naval architect or the materials engineer or the contract expediter; he may be the model-master—the designer and custodian of the network of models within which the ship's design and construction is studied and developed.

Ship design has thus reached a new level of abstraction: the problem is to design the process of design.

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Tech-Crostic
David L. and Judith G. Holt

Roots, Rare Earths and Ravelins

								N 1	F 2	B 3	I 4	A 5	H 6	D 7	S 8		P 9	W 10		V 11	K 12	O 13
	J 14	S 15	A 16	Y 17		Y 18	B 19	N 20	J 21		E 22	D 23	A 24	H 25	Y 26	G 27	I 28	S 29	B 30	K 31	
	A 32	T 33	P 34	Z 35		N 36	C 37	B 38	L 39		M 40	O 41	R 42	X 43		Y 44	Q 45	V 46		Z 47	
O 48	E 49	A 50	U 51		N 52	V 53	U 54		G 55	P 56	E 57	—	W 58	N 59	—	X 60	L 61	K 62	F 63	M 64	
	U 65	S 66	K 67	Y 68	H 69	A 70	V 71	N 72	F 73		E 74	O 75	M 76	Q 77	Y 78		E 79	M 80	P 81	B 82	
T 83	G 84	L 85	N 86	A 87	I 88		Q 89		F 90	X 91	V 92	C 93		A 94	Y 95	P 96	N 97	B 98	U 99		
U 100	M 101	E 102	W 103	N 104	A 105	Q 106	C 107	G 108	T 109	J 110	X 111	B 112		V 113	G 114		C 115	Q 116	Z 117		
H 118	E 119	J 120	N 121	C 122	F 123	W 124	Z 125	B 126		N 127	P 128	S 129	O 130	T 131	V 132	M 133	Z 134	Y 135	K 136	U 137	
D 138		O 139	F 140	N 141	I 142	H 143	S 144		E 145	M 146	N 147	Q 148	I 149	D 150	J 151	B 152	L 153		O 154	D 155	
A 156	N 157	R 158	K 159	Q 160		W 161	X 162		K 163	W 164	M 165	N 166		F 167	T 168	N 169	H 170		L 171	O 172	
N 173	M 174	X 175	A 176	W 177		C 178	Y 179		I 180	G 181	U 182	R 183	Z 184	S 185	H 186	N 187		U 188	N 189	W 190	
F 191	Z 192		Z 193	G 194	N 195	I 196	B 197		N 198	C 199	X 200	L 201	A 202	J 203	R 204	M 205	E 206				

Use the definitions at the right to help define the words to which they refer; then enter the appropriate letters in the diagram to complete a quotation from a scientific work. The first letters of the defined words give the author and title from which the quotation is taken. Black squares in the diagram indicate the ends of words; when there is no black square at the right end of the diagram, the word continues on the next line.

The correct solution to this Tech-Crostic will appear in the October/November issue of *Technology Review*.

David L. Holt is Assistant Professor of Metallurgy at M.I.T. He will welcome readers' comments; address him in care of *Technology Review*, Room E19-430, M.I.T., Cambridge, Mass. 02139.

A. In England, a furniture van.

156	50	87	32	176	202	94	16	70

24	5	105	

B. The 18th century in Italian art and literature.

126	30	82	38	19	197	98	112	3

152

C. German physicist, 1824-1914.

93	122	178	199	37	107	115

D. Country containing part of two continents.

23	7	138	155	150

E. Part of impedance of an alternating current circuit due to capacitance or inductance or both.

22	206	145	74	57	119	102	79	49

F. Capable of being mixed.
90 140 73 123 191 167 2 63

G. In U.S. law, a deponent.
108 114 55 84 194 27 181

H. Baffling situation or state; quandary.
186 25 170 118 143 6 69

I. Intuition; discernment.
196 149 180 28 88 4 142

J. An organic cyanide.
21 110 203 120 151 14

K. Drink; inhaling; taking in of a net.
31 159 12 67 136 163 62

L. Let go.
201 153 39 61 85 171

M. Powered mechanism supplementing a primary control operated by a weaker force; relay apparatus.
133 76 205 165 80 40 101 146 174
64

N. Expedition in Greek legend. (Four words).
147 189 104 198 157 173 20 72 52
187 1 86 59 195
121 141 97 169 36 166 127

O. Retaliation; redress of grievances.
75 172 130 48 41 13 154 139

P. Large tropical American lizard.
9 96 128 34 81 56

Q. Octahedrite.
116 45 89 106 77 160 148

R. Second canonical hour.
42 158 204 183

S. Underground rootlike stem.
129 8 185 29 15 66 144

T. American writer, 1836-1902.
33 83 131 109 168

U. Alloy of gold and silver.
54 137 65 100 188 99 182 51

V. Like a yellow iron ore in color.
71 92 11 53 113 132 46

W. Closed with or given the appearance of a structure of crossed strips.
124 164 10 161 58 103 190 177

X. Minor defense beyond the main body, as rifle pits, ravelin, etc.
162 91 175 60 111 200 43

Y. Skipping; frisking.
26 44 78 18 179 68 95 135 17

Z. Pertaining to a trivalent metallic element of the rare earth series.
184 35 117 125 192 193 134 47

June Crostic Solution

A peculiar defect which is associated with the presence of stresses in a number of alloys consists of their cracking while being in a condition where their environments remain constant or change only to a slight extent.—Sachs, *Sheet Metal Fabricating.*

California Here I Come!

No snow next year! My thesis adviser has received an appointment at the University of California at Santa Cruz (75 miles south of Berkeley) and was able to get an assistantship for me as well. And with some other help, my girl friend has been accepted as an extension student, and Brandeis was kind enough to give her a leave of absence with credit. The upshot is that starting in September I will be residing in the middle of a redwood forest about one mile from the Pacific Ocean in sunny Central California—enjoy the slush.

All correspondence should now be sent to me at the Mathematics Department, University of California, Santa Cruz, Calif., 95060.

Problems

41 The bridge problem this month, taken from the *New York Times* of January 4, reached me from some guy named Mattill from *Technology Review*. It is the hand with which two M.I.T. entrants—Mike Gurwitz, a recent graduate, and Mark Feldman, a senior—won the first trans-Atlantic bridge competition late last year. How did the winners do it?

	♠ K 9 4 ♥ 8 2 ♦ A Q 10 6 5 ♣ 8 6 2	
♠ Q 3 ♥ Q 10 ♦ J 8 7 2 ♣ K J 9 5 4		♠ J 10 8 6 ♥ A 9 4 ♦ 9 4 3 ♣ Q 10 3
	♠ A 7 5 2 ♥ K J 7 6 5 3 ♦ K ♣ A 7	

Neither side was vulnerable. The bidding:

North	*East*	*South*	*West*
Pass	Pass	1 club	Pass
2 diamonds	Pass	2 hearts	Pass
3 diamonds	Pass	3 N.T.	Pass
Pass	Pass		

West led the ♣ 5.

Here is a fairly easy number theory problem from John E. Prussing:

42 Show that for any positive integer n, $3^{2n+1} + 2^{n+2}$ is divisible by 7.

Here is a somewhat harder one from Warren Himmelberger:

43 Two brothers owned an orange grove. After their oranges were picked, one brother divided them into 39 baskets and found that there were 16 oranges left over. The second brother then took all of the oranges and put them into 56 smaller baskets, finding that there were now 27 oranges left over. What is the smallest number of oranges possible, and what are the next four larger numbers of oranges which fulfill the conditions?

Walter Penney sent in the following combination game and mathematical problem with a message included:

44 The letters of a saying are written in order on squares 1 to 32 of a checkerboard with the usual numbering system. A certain game of checkers might then be written:

1. R — Y E — H	10. F — O N — B
2. E — R H — B	11. S — W E — T
3. F — O N — B	12. E — T W — H
4. I — H H — B	13. T — F I — N
5. O — E I — N	14. F — O N — B
6. T — I W — H	15. W — M I — I
7. I — H H — B	16. Y — O B — I
8. B — T R — W	17. H — B S — N
9. T — F E — I	18. O — S D — H
	19. D — H Drawn

Finally, a magic square—which he describes as "a square matrix of numbers such that rows, columns, and diagonals all sum to the same total"—from David DeWan:

45 Determine an 8 × 8 upside-down magic square from the 64 three-digit numbers made of the digits 1, 6, 8, and 9.

Speed Department

Our first quickie is from Arthur W. Porter:

SD13 Consider the case of a bookshelf containing a set of nine volumes, with volume I at the left and volume IX at the right. The thickness of the pages (from page 1 to the last page, inclusive) in each book is 1". (The books are paperbacks, so the cover thickness is negligible.) If an enterprising bookworm starts eating at page 1 of volume I and proceeds right, eating his way through to the last page of volume IX, how far does he travel?

Our final selection for Volume 73 is a classic probability problem from Russell A. Nahigian:

SD14 Suppose that one is present in a room in which there are n people. What must n be to make the probability greater than 50 per cent that two persons in the room have the same birthday? (Disregard leap years.)

Solutions

26 Given the following hands, South the successful bidder at 4 spades, and the opponents' lead of ♣ 7:

	♠ K ♥ 9 5 4 2 ♦ K 7 ♣ K Q J 8 6 5	
♠ 8 6 ♥ K J 10 6 3 ♦ A J 9 6 3 ♣ 7		♠ 7 4 ♥ A Q 8 ♦ Q 4 3 ♣ A 10 4 3 2
	♠ A Q J 10 9 5 3 2 ♥ 7 ♦ 10 8 2 ♣ 9	

Do you choose offense or defense? The following solution is from Charles L. Eater, III:

If the defense plays his hand properly, there is no way the declarer can make four spades. East takes the first trick with the ♣A, then follows with the ♦Q. At this point if declarer refuses to cover with his ♦K, the defense can take its two aces—♥A and ♦A—and declarer will be down. If the declarer covers with the ♦K, he is on the board with no safe lead. If he leads a heart or a diamond he will lose to the defense which can then lead a trump to get rid of dummy's ♠K. At this point a diamond or a heart lead will either force declarer to his hand with a trump—if he played a heart earlier—where he will eventualy be forced to give the defense two diamond tricks; or it will lose to the defense who can then take the necessary tricks. A club lead will force declarer to trump in his hand where he will again have to lead a diamond or a heart eventually. If, at the third trick,

he led a spade or club, the same problem would arise—that is, he would eventually be in his hand and would have to lead a diamond or a heart to the defense.

Also solved by John Babbitt, Philip D. Bell, Shirley V. Bugg, Ed Gershuny, Winslow H. Hartford, Elmer C. Ingraham, Michael A. Kay, Mrs. Martin S. Lindenberg, John W. Meader, R. Robinson Rowe, John P. Rudy, Gene Schacht, Les Servi, Richard Simon, Hugh D. Sims, and the proposer, Paul D. Berger.

27 Three hoboes spent the day gathering aluminum cans to sell back to a can company for ½¢ each. That night they left the cans in a pile to be divided equally in the morning. During the night one hobo decided he wanted his share then. He divided the cans into three equal piles and had one odd can left over. He took his pile, pushed the other two piles back together, threw the odd can on the big pile, and stole away into the night with his cans. Later another of the hoboes did the same thing: three equal piles, one odd can left over, took his share, threw the odd can on the big pile, ran away. Still later the third hobo did the same thing and had the same experience with one can. After the hoboes had left, the number of cans in the big pile was exactly divisible by three. In the morning a fourth hobo found the pile left behind by the others and sold them to the company. How much money did he receive? (Hint: it was less than 25¢.)

This was submitted by Winslow H. Hartford:

If 3x is the number of cans left, by calculating back we find the original number was $[27(3x - 1)]/8 + 1 = (81x - 19)/8$. This becomes integral when $x = 3$; $3x = 9$ and the fourth hobo got 4½ cents. There were originally 28 cans:

Pile	Hobo takes
28	9
19	6
13	4
9	

Not much of a day's work! The algorithm is also integral if $x = 11$, $3x = 33$, and the fourth hobo gets 16½ cents. Now:

Pile	Hobo takes
109	36
73	24
49	16
33	

Also $x = 19$ gives $3x = 57$, and the return is 28½ cents.

Also solved by John Babbitt, Clark Baker, Raymond Gaillard, D. P. Gaillard, Ed Gershuny, Elmer C. Ingraham, Michael A. Kay, Mrs. Martin S. Lindenberg, Ross Rapaport, R. Robinson Rowe, James W. Royle, Jr., John P. Rudy, John Schwarz, Les Servi, Ermanno Signorelli, Hugh D. Sims, Smith D. Turner, and Harry Zaremba.

28 Solve the following learning curve formulation for B:
$A + 1 = N^{1-B} + AB$,
knowing that there is only one solution in the range $0 < B < 1$.

Charles Wells writes that he does not believe the problem has an "exact" solution, that it must be solved by approximation. (But, he asks, "what is an 'exact' solution, anyway? The solution to this problem is surely irrational, and irrational numbers can only be approximated.") Mr. Wells continues:
However, one can say when the problem has no solution at all. Note that one must have $N \geq 0$. Setting $x = (1 - B)$, the problem is to find x with $0 < x < 1$ such that $N^x = Ax + 1$; or, in other words, when does the curve $Y = N^x$ intersect the straight line $Y = Ax + 1$? They intersect at 0. If they intersect again between 0 and 1, then since $Y = N^x$ is concave upward (first derivative is $N^x \log N$, second is $N^x \log^2 N$), the slope of the line $Ax + 1$ must be larger than the slope of the line tangent to the curve at 0 and smaller than the slope of the secant line cutting the curve and 0 and 1. It follows that the problem can be solved if and only if $\log N < A < N - 1$. Note that there are such A for all non-negative N except $N = 1$. The solution, when it exists, can be approximated by bisection (for example).

Also solved by John Prussing, R. Robinson Rowe, John P. Rudy, and Smith D. Turner.

29 In how many different ways can eight numbers be rearranged such that no number occupies its original position? Write out all the possibilities. Find the answer for n numbers in general.

R. Robinson Rowe writes:
This was an interesting problem until I came to the assignment of "check your answer by writing out all the possibilities." Using 1, 2, 3, 4, 5, 6, 7, and 8 for the eight numbers, I have limited my check list to the first two and last two, viz.:

Ordinal	Arrangement
1	21436587
2	21436785
gap	
14832	87654312
14833	87654321

For n numbers, in general, if we let A_n be the number of arrangements:
$A_n = (n - 1)(A_{n-1} + A_{n-2})$, with $A_1 = 0$ and $A_2 = 1$, whence

n		A	.37n!
1		0	0
2		1	1
3	2(0 + 1) =	2	2
4	3(1 + 2) =	9	9
5	4(2 + 9) =	44	44
6	5(9 + 44) =	265	266
7	6(44 + 265) =	1854	1865
8	7(265 + 1854) =	14833	14918

I have shown in the third column that A is approximately proportional to n!; instead of 0.37, the proportionality factor is nearer 0.3769—or 0.367894

In a second letter, Mr. Rowe writes that the above "began to look familiar," and so he "looked it at some more" after mailing the first letter:
Consider the series
$1/2 - 1/6 + 1/24 - 1/120 + 1/720 - \ldots$
with alternating signs and successive factorials as denominators. Its convergents, including an initial null, are
0, 1/2, 1/3, 3/8, 11/30, 53/144, . . .
which are equal to the successive ratios $A_n/n!$
0/1, 1/2, 2/6, 9/24, 44/120, 265/720, . . .
and the limit of the series is
0.367 879 441 172 . . . = 1/e, leading to the approximation $A_n = n!/e$. I have tested this approximation for all n up to 8, for which $A_8 = 40320/e = 14832.89907$ . . . The result rounded to the nearest integer is correct. Hence for a supplementary answer to the quest for a general formula for the number or arrangements of n numbers with none in the initial position, I submit $A_n = [n!/e]$, where the brackets mean "nearest integer to."

Also solved by John Babbitt, Ed Gershuny, R. Robinson Rowe, Smith D. Turner, Charles Wells, and Harris Zaremba.

30 Given the notations
$f: R \to R$,
$\Delta_t f(x) = f(x + t) - f(x)$,
show that there exists f continuous such that
$\lim_{x \to +\infty} \Delta_t f(x) = 0$ for all rational t; and
$\lim_{x \to +\infty} \Delta_t f(x)$ does not exist for almost all (measure-theoretic) t.

This was solved only by the proposer, Charles Heiberg:

Define intervals I_n $(n = 1, 2, \ldots)$ of length $2n + 1$ so that $I_1 = [0, 3]$, $I_2 = [3, 8]$, $I_3 = [8, 15]$, etc. Define
$g : R \to R$ by
$g(x) = 0$ if $x \neq (0, 1)$
$g(x) = 1$ if $x = y_2$
$g(x)$ is linear on $[0, ½]$ and $[½, 1]$.
Write I_n as the union of $2n + 1$ closed intervals of unit length

$J_{-n}^n, J_{-(n-1)}^n, \ldots J_{-1}^n, J_0^n, J_1^n, \ldots J_n^n$
such that $i < j \geq -J_i^n$ is to the left of $-J_j^n$ of the real line.

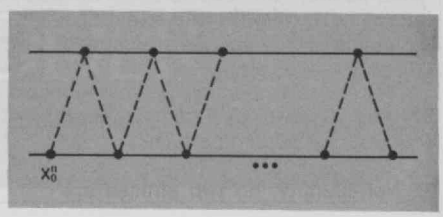
Let $f(x) = \sum_{n=1}^{\infty} \left[\sum_{j=-n}^{n} (1 - |j|/n) \right.$
$g(nx + x_j^n)$
where x_j^n is the left end point of J_j^n.

Then $|\Delta_{1/n} f(x)| \overset{A}{\leq} 1/n \quad x \geq x_j^n$, $(n = 1, 2, 3, \ldots)$

So $\Delta_{1/n} f(x) \to 0$ as $x \to +\infty$.
But $\{t : \Delta_t f(x) \to 0$ as $x \to +\infty\}$ is a group, since
$\Delta_{-t} f(x) = -\Delta_t f(x - t)$
$\Delta_{t+s} f(x) = \Delta_t f(x + s) + \Delta_s f(x)$. So

$\Delta_t f(x) \overset{A}{\to} 0 \quad t \in Q$.

Now on J_0^n. f(x) looks like this:



(Continued on p. 71, col. 3)

Comments and Corrections

Examining Simulation

To the Editor:
I have read with interest Jay W. Forrester's article "Counterintuitive Behavior of Social Systems" (*Technology Review* for January, 1971, pp. 52-68) and his books to which he refers; and I have shared the article with several colleagues whose views seemed likely to be significant.

General agreement on the following points seems clear:

◇ Whether we are in every instance aware of doing so or not, we invariably use the technique of simulation ("modeling," or "mapping") to describe, or even think about, what goes on in the universe, including "social systems."

◇ No "social system" can have either its past history adequately described or its future behavior realistically predicted in terms of "models" which operate *deterministically* instead of *probabilistically*, as do living creatures.

◇ Our intuitive models (consciously or unconsciously used) concerning how "social systems" operate are too often proving dangerously erroneous.

On the other hand, disagreement arises in answering the following questions:

◇ What is the "structure" of that class of "maps" which lead to "dangerously erroneous" predictions?

◇ Or, conversely, what is the "structure" of that class of "maps" which will *not* prove "dangerously erroneous"?

One of the best approaches to answering questions about "structure" is this key question: By what mechanisms does a dynamically-changing "organism," operating on the basis of incomplete "information," manage to keep himself intact and growing in the midst of a dynamically changing environment?

To answer this question we must make consistent use of three concepts ("structures") listed below:

◇ Non-identity: no two entities are ever identical; no one entity ever remains unchanged.

◇ Self-reference: Any "particular person," by pointing out the concepts ("structures") underlying both his arguments and the "system" within which he sees himself as operating, explicitly takes into account the issue of self-reference.

◇ Directive correlation: a temporally-ordered sequence (implying a dynamic "boundary" between "organism" and "environment") arising from common variables—initial conditions which affect both "organism" and "environment" —followed by responses of "environment" and "organism" to the common variables; and these responses in turn interact to achieve the focal conditions ("goals") of the "organism."

Professor Forrester's simulation technique ignores the concept ("structure") of non-identity; fails to take into account self-reference; and does not make use of directive correlations, common variables, responses (of environment *and* organism), and focal conditions. Therefore, as I see it, the variety of Professor Forrester's simulation technique is *not* "requisite" for predicting realistically the future of "social systems."

Clearly the concern about improving the technique of simulation extends far beyond the halls of the M.I.T.'s Sloan School of Management and the dome of the Institute. Many professional groups are involved, and in our attempts to achieve improved simulation we cannot afford not to make full use of "structures" tested by many workers—including those of Professor Forrester himself.

Lawrence W. Conant
Washington, D.C.

Must Research Be Value-Laden?

To the Editor:
I would like to point out a logical flaw in "New Directions for Urban Research," by Anthony Downs (*March, 1971*). He states, concerning research into individual and social values, that "this is an extremely difficult subject to study. Moreover, it is by definition 'value-laden,' so no one can be wholly objective and scientific about it." (*p. 30*)

But Mr. Downs defines this research as an investigation into "the nature, formation, and operation of individual and social values in our modern world." It does not follow from this definition that the investigation *itself* would have to be value-laden. In fact, the author goes on to ask questions about values and society which do not appear to depend for their answers on whatever values the investigator might happen to have. Just because one is studying values does not therefore make one's study value-laden: it is a mistake to think that, in science, the subject-matter will affect one's *methodology*, while it is a truism that the subject-matter will determine one's *techniques*.

Theodore June Kalikow
Newtonville, Mass.

On "The Old Bull"

To the Editor:
It will be of interest to see in the future if the writer of the unsigned article "The Old Bull Uncornered" in *Technology Review* for March, 1971 (*pp. 70-71*) can equally be categorized at an age comparable to Dr. Teller's "that he was a man," "he said what was really on his mind;" or if he will have achieved in proportion to the accomplishments of Dr. Teller as a senior scientist.

At this time, with the ever-changing cliche slogans and witless winds of change which push so many young and old around in all directions, like so many gaudy tin-tinkered weathercocks, it is good to see that there is a seasoned man who can speak his mind like a man, and in a manner that is not tinged with the false, handwringing humility so frequently posed.

Dr. Vince Moseley
Charleston, S.C.

To the Editor:
You discuss Edward Teller as of "enormous frame." What do you mean? He was a small man as of 1954 when

I met him. Will you please tell me how tall he is and how much he weighs now?

Cyrus Francisco
Lexington, Ky.

That Technology Review*'s article appeared without attribution was a mechanical error; the author was Deborah Shapley, then Associate Editor of the* Review, *who is now a member of the staff of* Science. *We are informed that Dr. Teller's present weight is 180 lbs., height 5'9"; obviously his "enormous frame" and "domination of the session" were less literal than figurative in Miss Shapley's eyes.*—Ed.

Misguided Amusement

To the Editor:
I find the advertisement placed by Vappi and Co., Inc. in your April, 1971 issue (*p. 75*) in very poor taste. I'm sure I'm not the only woman for whom this picture brings back disgusting memories of dirty construction workers yelling "Hey, Baby, come to poppa," of cabbies wolf-whistling, and of truck-drivers honking madly as they pass. (And those aren't regarded as compliments, especially by women with enough brains and ambition to be at M.I.T.) I hope that you will suggest to your advertisers that this sort of ad might be replaced by something that is not so offensive to some of your subscribers.

Janet Louise Mangold
Pittsburgh, Pa.

Miles and Years Apart

To the Editor:
Fantastic! I never dreamed that another galaxy was so close to us (closer, that is, than Pluto) (*see photo caption, p. 15, May*). Perhaps you mean 340 million light years away?

Joseph J. Di Certo
New York, N. Y.

Mr. Di Certo is correct, of course. It is the Editors' error, but author Michael P. Charette (See *Technology Review* for May, pp. 34-41) *has the last word: "Although a light-year is approximately six trillion miles, thus causing an error of several orders of magnitude, you can assure Mr. Di Certo that if he is planning a trip he will not notice the difference immediately."*—Ed.

Greenhouse Sterility

To the Editor:
The innocent suggestion of David G. Prosser (*"Correspondence Review" for May, 1971, p. 82*) of the advantages of using waste heat for greenhouses (*originally suggested in "Saving Waste Heat" in "Trend of Affairs" for February, p. 55)*—particularly that "it should not be necessary to apply insecticides, pesticides, etc., in the enclosed environment . . ."—was, for me, the last straw. I have read (mostly in publications other than *Technology Review*) the promotion of high-efficiency artificial lighting and many other proposed technological aids to greenhouse agriculture on the same basis—usually with much more pomp and portent—closed system, no bugs, no disease.

Nonsense!

Greenhouses are beloved by bugs and disease, because they are warm and humid and contain few natural hazards and predators. Some destructive species (such as whiteflies) flourish in the greenhouse and are controllable there only by the most persistent or toxic insecticides, whereas outside the greenhouse they are almost unknown as garden pests because they are naturally controlled. And they always find their way in—"completely enclosed" is a dream.

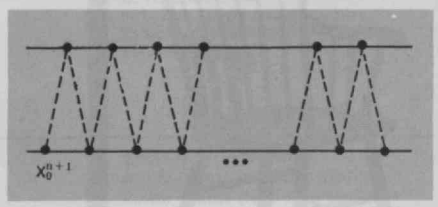
I can only wonder how much more foolishness of this sort exists in "environmental" circles, and how many bandwagoneers are thus now contributing mightily to the surplus fertilizer runoff problem.

Robert M. Rose
Cambridge, Mass.

The writer is Associate Professor of Metallurgy and Materials Science at M.I.T.—Ed.

(Continued from p. 69)

where the distance between small vertical bars is 1/2n.
On J_0^{n+1}, f(x) looks like this:



where the distance between small vertical bars is as above.

So $m\{t \in [0, 1] \cdot \ni \cdot \Delta_t f(x_0^n) \leq 1/2$,
$\Delta_t f(x_0^{n+1}) \geq 3/4\} \geq 1/8$

So $\exists\ t_0 \in [0, 1] \cdot \ni \cdot \Delta_{t0} f(x_0^n) \leq 1/2$,

$\Delta_t f(x_0^{n+1}) \geq 3/4$
for infinitely many n.
So $\lim_{x \to \infty} \Delta_{t0} f(x)$ D.N.E. But
$S = \{t : \lim_{x \to \infty} \Delta_t f(x) \text{ exists}\}$ is a group.
To $\notin$ S, so S is a proper subgroup of R, so mS = 0.

Address problems and solutions to Allan J. Gottlieb at the Mathematics Department, University of California, Santa Cruz, Calif., 95060.

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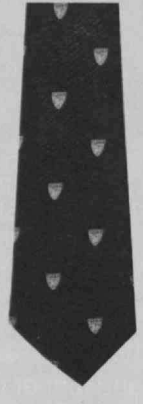

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Institute Review

Electronic Music, But a "Wonderful Day in the Sun"

Though the long hair of some of the graduates raised eyebrows and the cacophonous sound of electronic music offended many eardrums, President Howard W. Johnson had no dissenters when he described June 4—the Institute's 105th Graduation Exercises—as "a wonderful day in the sun." There were 1,240 graduates—including a record 71 women—who received a total of 1,422 degrees.

As principal speaker, Mr. Johnson urged the graduates "to care in new ways for M.I.T. and for the institutions where you live and work the rest of your lives. . . . The future of these institutions—and the world—will depend on that kind of personal caring on the part of each of you," he said (*see page 76*).

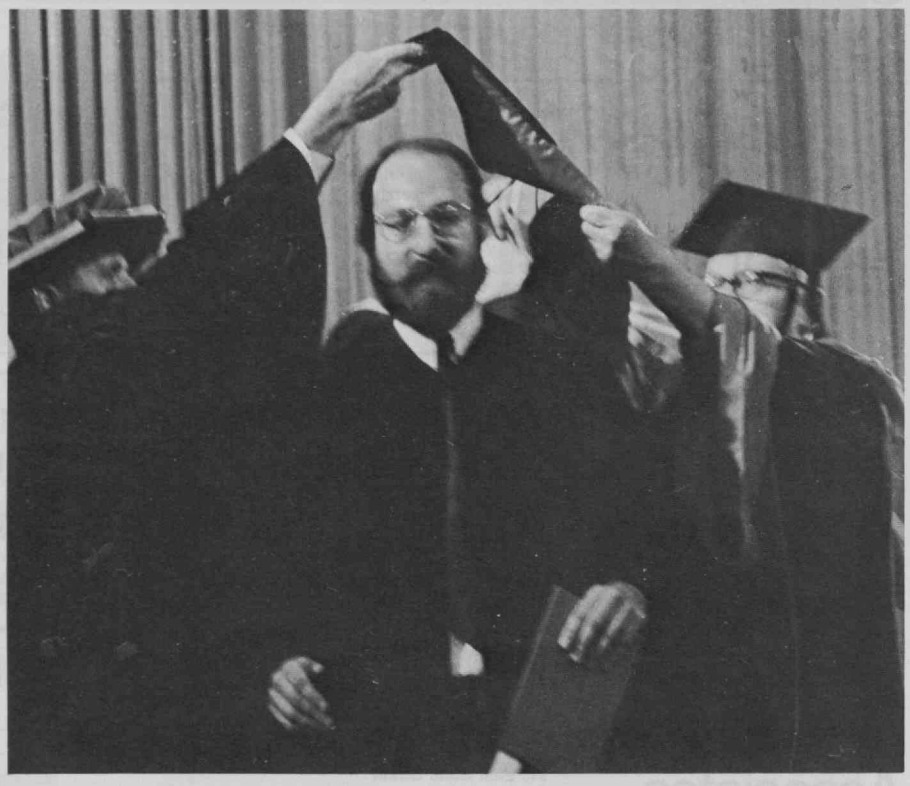
It was the last Graduation at which James R. Killian, Jr., '26, would preside as Chairman of the Corporation, an assignment from which he retired July 1. There was a standing ovation from more than 3,000 guests in Rockwell Cage.

The degrees awarded included 147 doctorates, 72 engineer degrees, 429 master's degrees, and 774 bachelor's degrees; 45 bachelor's degrees and 26 graduate degrees were given to women.

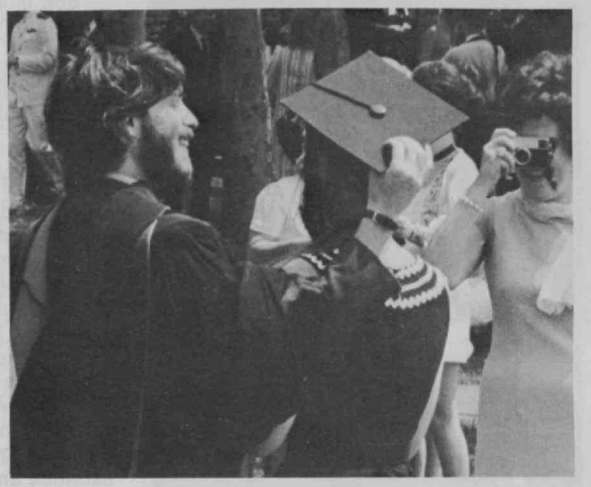
By far the most startling feature of the occasion was the music—by the traditional brass ensemble under the direction of John D. Corley, Jr., Assistant Director of Music at M.I.T., who played in a loose interrelationship with electronic music written especially for the occasion by Paul Earls, a Fellow at M.I.T.'s Center for Advanced Visual Studies, and better-known electronic works by the composer Bulent Arel. Mr. Arel supervised the performance of his Stereo Electronic Music #2 (1970) during the prelude to the Graduation Exercises, and his Postlude for Sacred Service (1961) provided the interlude.

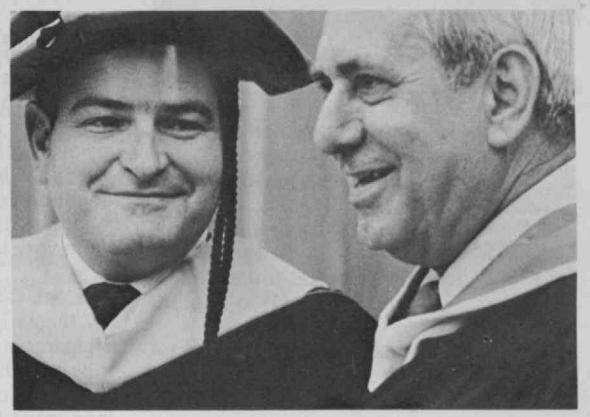
The electronic works were presented at the invitation of Klaus Liepmann, Director of Music at M.I.T., and the Commencement Committee composed of faculty and graduate students. It was said to be the first performance of electronic music "on a large scale, outside of concert halls." Professor Earls, proposing that such works may be especially appropriate for events in the nature of public celebrations, said that "there is a need to enhance, to enrich and to be useful." His "Processional Music" alternates short phrases of a march for brass with electronic interludes—both of variable length and development as the occasion demands. The electronic interludes were accompanied by percussion from the brass choir, and a separate electronic track provided the basic cadence for the processional march.

Though Mr. Earls anticipated some criticism by announcing in advance that his effort was "not a discotheque," he may have underestimated the power of eight loudspeakers to impair the hearing of those nearest to them and to overpower the brass choir for most of those in the Cage.



Commencement 1971 included all the usual scenes—and a few unusual ones. Among the latter: a standing ovation at the Commencement Luncheon for James R. Killian, Jr., '26 when Howard W. Johnson, President of M.I.T., introduced him ("Through monumental contributions and personal sacrifice, he has guided and directed the Institute to its highly respected status") as retiring from the post of Chairman of the Corporation (opposite, lower left); Paul V. Keyser, Jr., '29, Chief Marshal as President of the Alumni Association (opposite, top left); and the participation as an honored guest of Alfred Vellucci, Mayor of Cambridge (opposite, center right, with Paul E. Gray, '54, Chancellor of M.I.T.). (Photos: Owen D. Franken, '68)





Howard W. Johnson
Chairman of the M.I.T. Corporation

Are We Failing Our Institutions?

The following are excerpts from the address by Howard W. Johnson, then President of M.I.T., to the Institute's 1,200 graduates at Commencement Exercises on June 4:

Caring for one's fellow man is the essence of civilized society. Without it we are reduced to automatons, optimizing gain. Faulkner was right when he said: "There is no room in man for anything but the old verities and truths of the heart—love and honor and pity and pride and compassion and sacrifice. Man will not merely endure. He will prevail. He is immortal not because he alone among the creatures has an inexhaustible voice but because he has a soul, a spirit of compassion and sacrifice and endurance."

But caring on an individual basis is no longer enough. The world in general has become too crowded and too complex for caring on a one-to-one basis (important as individual caring will always be to sustain a good society). But individual caring—alas—is undependable. Much of caring must be mediated through institutions, some of them very large institutions.

Interest, Compassion, and Concern

My thesis is that change in institutions, often required in our times, will be truly effective only if we care for them—as institutions. The institution itself then must be the object of intense human care and cultivation. Even when it errs and stumbles, it must be cared for. And the burden must be borne by all who work for it—all who own it, all who are served by it, all who govern it—to care with somewhat the same response to its needs that one would give an individual person. This is difficult. It is hard to see the institution as a human entity—especially the larger institution. The courts have been willing to see the corporation as a person and to give it the constitutional rights accorded literally in the Constitution only to persons. But it is hard for us to see that.

Our society is suffering from disorder and injustice because the institutions in it are not good enough to meet our needs in them. None of them is good enough—businesses, churches, schools, governments. Across the board, our institutions fall short, judged by what they are expected to attain with the resources they have. This is because not enough of the people who influence their quality care for these institutions.

Institutions are seen as instruments to be used and exploited. The result is just as corrupting to an institution as if the same treatment were accorded an individual person. And so companies, and organizations, and armies, and schools —not to mention churches and governments—fall short, and society suffers, which means everybody, because its institutions, like human beings without care, are corruptible or set their goals too low.

Caring, we know, is an exacting and demanding business. It requires not only interest and compassion and concern; it demands self-sacrifice, wisdom and tough-mindedness and discipline. It is difficult to care, even for the immediate person one loves and respects. It is much more difficult to care for an institution, especially a big one which can look cold and impersonal and seem to have an autonomy all its own. Yet a commanding majority of people must care for our institutions if we are to have a society worth living in. Every person who thinks of himself as responsible must care for every institution he touches; and for those he touches intimately, he must care deeply.

And it is my belief that when you care for an institution, it becomes in fact more susceptible to effective change.

Universities as Cities on the Hill

Now I bring this home to the university. Universities in general fall far short of the quality they might achieve because too few people, among their several constituencies, really care. It is assumed by some that only a few—some administrators, some faculty, some students, some trustees—have the burden of sustaining the institution, while everybody else, to some extent, uses it. Having watched this particular institution from a good vantage point these past years, I am convinced that the quality of what M.I.T. has achieved

in the past, and still is achieving, will not endure unless a substantially greater number in all of its constituencies examine their own roles and shift more of their involvement from using to caring. I mean faculty, staff, students, alumni, Corporation, and administration.

To many observers, the university today appears to be the most fragile, the most troubled, and least certain of its goals among all institutions. At the same time it has the chance to become the strongest and the surest-footed—the pace-setter for the next great social advance. It has this chance because it contains the human resources of intelligence, energy, and vitality that can make of the university an inspiration for all society. There is no question that the university has had these resources, the autonomy, and the skills to be an exemplary institution; yet, at this moment, the universities are far from being an inspiration—a city on the hill—for the people of our time.

What I have said about the centers of learning can be extended to those other institutions we value: the nation, the corporation, the community, and the family. They must be cared for if they are to be preserved, if they are to change vitally, if they are to become the places on the hill—visible, effective, responsive, incorruptible.

Among centers of learning, some university must take the lead, for its own preservation and the preservation of all universities. I believe M.I.T. can be that one university. Beyond becoming an institution where all the constituencies care, where the search for truth is paramount, where compassion is part of principle, we should make this Institute a center where more of the whole meaning can be extracted from experience.

I hope that your concerns for the improvement of society continue to draw on the finest of ideals and continue to translate to action that is effective. I hope, too, that you find yourselves encouraged to care in new ways for M.I.T. and for the institutions where you live and work the rest of your life. The future of these institutions—and of the world—will depend on that kind of personal caring on the part of each of you.

In a period when many are finding reasons or excuses to turn away from the universities, I know of no more important task than that which we, all of us, confront here: to reaffirm our faith in the purposes of this Institute in the service of learning, and to give it our care and our support as we enter this last quarter of the 20th century.

Quiet Words on Black Politics

The Class of '71 Commencement convocation speaker was Julian Bond, 31-year-old member of the Georgia House of Representatives who helped to found the Student Nonviolent Coordinating Committee in 1960. Mr. Bond himself graduated from college this year with a degree in English, having picked up the thread of his studies after a decade of more pressing activities, during which he became among other things a recognized poet.

In a quiet, ironical tone, he delivered a speech recommending that black Americans should form broad-based political organizations at the local and state levels, which could link together, reach some kind of consensus, and influence ordinary electoral processes either by collectively supporting particular candidates among those produced by the major parties, or by offering candidates of their own. He quoted the late Dr. W. E. B. DuBois twice: first, a DuBois afterthought on his celebrated statement to the effect that the color line is the great problem of this century —back of that problem is an even greater one, that so many people are prepared to live in comfort when the price of that comfort is the suffering of others; second, DuBois' "creed"—belief in God who made all races, differing in no essential particular, alike in soul . . . (but "I'm not sure about that," said Mr. Bond).

Announcing "Q. and A. time" (with the very quiet aside, "Some of you probably think *you're* the Q.") Mr. Bond parodied, in anticipation, those who on such occasions give little speeches of their own instead of asking questions. "There is only one speech on the program, and it's over."

What was being done to organize the independent black electorate he envisaged? Not much. In the north, the black electorate was a tool of the Democrats; most independent activity was in the south.

How could whites help? Most of them weren't interested, but they could, for a start, use the vote, or they could assist in the organization . . . there were a wide variety of ways. What was the role of young blacks? In general, the young were not interested in the political process; most of the work was being done by older people.

What will be the effect of the 18-year voting age? Well, in Georgia, unlike these more advanced states in the north, the voting age has been 18 for many years. Those that vote at all will mostly vote as their parents do.

Did he favor an all-volunteer army, which might prove to contain a disproportionate number of blacks? Yes, he did, in spite of that fact.

Julian Bond, of the Georgia House of Representatives, was invited to the Institute by the Class of '71. Mr. Bond, a founder of the Student Nonviolent Coordinating Committee, spoke of how the black minority might organize for effective representation in the electoral process. Unlike most commencement speakers, the young politician was pessimistic about the possible usefulness of young people.

R.O.T.C. Commissioning

M.I.T.'s 1971 R.O.T.C. cadets—who received their commissions at exercises which opened Commencement activities on June 3—are assured of careers which will afford them "the opportunity and satisfaction of working for the common goals of society," according to Vice Admiral Edwin B. Hooper, S.M.'40, Director of Naval History.

Admiral Hooper, speaker at the commissioning exercises, spoke of his admiration for the "moral courage" of young men who join the armed forces today. But he assured them that in today's troubled times and uncertainties, military power is a major factor in world affairs. And its importance will not diminish in the future, he declared, for force will continue to be "an essential element in world peace."

Commissions were given to 14 cadets in the Regular Army and Army Reserve, 11 in the Navy and Naval Reserve, and 11 in the Air Force, all members of the Institute's Class of 1971.

After receiving acclaim from an Alumni Homecoming audience whose applause would not be silenced, James R. Killian, Jr., '26—retiring as Chairman of the M.I.T. Corporation after more than 45 years' service to the Institute—called his colleagues to the platform for an historic picture of three generations of M.I.T. leadership: Howard W. Johnson, Chairman of the Corporation, who left the Presidency on June 30; Paul E. Gray, '54, Chancellor; and (right) Jerome B. Wiesner, President. (Photo: Owen D. Franken, '68)

Reunions and Homecoming: How Summer Came at Last

When Arthur Fiedler raised his baton to open "M.I.T. Night at the Pops" on June 6, some 2,300 M.I.T. alumni and their guests were in the audience. And before the two-day Alumni Homecoming was over, another 700 had arrived for campus activities on June 7—a total of 3,000 visitors to the Institute for what turned out to be New England's first week-end of summer weather.

Reunion Records

The week-end had already seen a series of unusually large class reunions, four of them—more than ever before—on the campus. Among the reunion highlights:

◇ 1916—at Chatham Bars Inn—set a new record for the percentage of class members present for a 55th reunion.

◇ 1921—in McCormick Hall on the campus—may have set a record for spirit, if not for numbers, for a 50th reunion. A highlight came when Jerome B. Wiesner, new President of M.I.T., was awarded honorary membership in the Class. Responding, Dr. Wiesner admitted that anticipating his new duties as President, he found M.I.T.'s opportunities both frightening and exciting. Why did he take on the job? "Because I'm inclined to be hopeful. . . . Many people would shut off technology to solve our problems, because our problems seem to stem from technology." But this is no solution, said Dr. Wiesner. "Both technology—and M.I.T.—have a responsibility to confront, not shrink, from problems."

◇ 1951—at Provincetown Inn—set a fourth new record in percentage of the class attending; already it held attendance records for 5-, 10-, and 15-year reunions. Howard W. Johnson, an honorary member of the Class since 1966, was the reunion guest and—in tribute to his service as President of the Institute—was given a 6-in. facsimile of the class ring, hand-carved on Nantucket by Fred W. Aldrich, Jr., '51.

◇ 1956—to keep in touch with the campus—invited Richard A. Sorenson, Associate Dean for Student Affairs, to attend its Edgartown reunion and report on current M.I.T. affairs. Mr. Sorenson was not available for comment as this issue went to press, but his secretary told *Technology Review* that "he had a ball."

Four campus reunions together provided leverage for special features over the week-end—a session with faculty on "Inside M.I.T.—1971" Saturday morning (*see below*), a series of "old favorite" movies throughout the week-end, and a special Kresge performance of *The Proposition* Saturday night. The mixing of old and young alumni was an added advantage which many had not anticipated.

Alumni Homecoming

"The Great Debate," two panels on technological problems and educational institutions' possible responses, turned out to be less a debate than a series of expositions; it is reported elsewhere in this issue.

Speaking at the annual Alumni Homecoming Luncheon on Monday noon, President Johnson summarized his views of M.I.T. from the President's Office, which he would shortly vacate. "We have been tested," he said, and there were occasions when the survival of the Institute may have been in the balance. But M.I.T.'s response was far from "an exercise in containment," he declared, "for the Institute has made progress toward our basic goal of better education, research, and service.

"I submit that history will stand; that M.I.T. will remain an institution which has produced a long line of men and women who take their places as doers," he said. "This relatively small institution ranks as it does in the forefront because of what people have done for it over the years. It belongs to all of you." The standing ovation could hardly have been misunderstood.

The day ended with an Alumni Assembly in Kresge Auditorium in tribute to James R. Killian, Jr., '26, who retired as Chairman of the Corporation June 30 after 45 years' service to the Institute. David A. Shepard, '26, was chosen to describe how Dr. Killian first came to M.I.T. and "how he has been holding up the walls of the Institute ever since;" and to present the Alumni Association's gift: a book—of which only one copy exists boxed, in boards—listing his principal articles and addresses with an introductory essay by John E. Burchard, '23, Dean Emeritus of the School of Humanities and Social Sciences.

Dr. Killian was obviously moved; he spoke of his experience greeting more than 5,000 alumni at meetings throughout the U. S. this spring, and there were some light-hearted remarks about "tall stories from this tall man." Then there assembled on the Kresge stage three generations of M.I.T. leadership: Dr. Killian, Mr. Johnson, President Jerome B. Wiesner, and Chancellor Paul E. Gray, '54.

The reception following—though it gave some 1,000 alumni and their families a chance personally to greet Dr. and Mrs. Killian, was by any estimate an anti-climax.

Reunion Gifts: $1.7 Million and the "Class of 1921"

Reunion gifts totalling $1,776,931 were announced by the 50-, 40-, and 25-year classes at the 1971 Alumni Homecoming Luncheon on June 7. The funds were raised in intensive efforts of the three reunion classes over the past five years.

Climaxing the 50th reunion of the Class of 1921, Irving D. Jakobson, Vice President of the Class who was its Reunion Gift Chairman, announced a total gift of $700,583. The gift, he said, resulted from contributions by 326 members—76 per cent—of the Class.

Not included in the gift and separately announced by Mr. Jakobson was the fact that 43 members of the Class have included the Institute in their estate plans; a "conservative estimate" of the present value of these bequests is $985,000, Mr. Jakobson said. The number of classmates making such provisions for M.I.T. is larger than known for any other Class, he declared.

An added fillip came when Mr. Jakobson called for those of his classmates who had participated in crew as M.I.T. undergraduates 50 years ago to come forward; seven responded. They were, it turned out, members of M.I.T.'s first crew, having used a shell "cast off by Harvard" to row M.I.T.'s first intercollegiate race in 1920. In commemoration of the event, they unveiled the "Class of 1921," a new eight-oared shell ready to join the M.I.T. fleet. After an appropriate christening with well-splashed champagne, Mr. Jakobson announced that the "Class of 1921" would ride the Charles River's waves in perpetuity. "When this shell reaches the end of its useful life," he said, "we wish it to be replaced." The Class had established a fund which would assure replacements as needed for "as long as rowing is a sport at M.I.T."

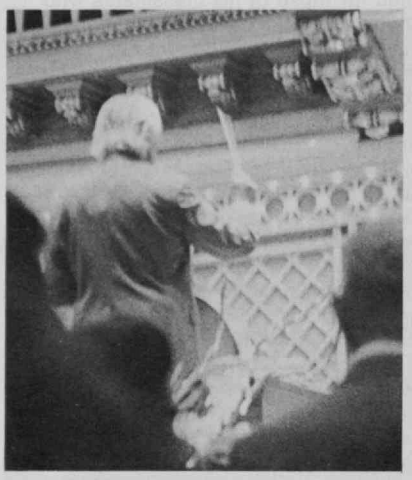
When the applause ended and the program resumed, Mrs. Margaret Compton was called to the rostrum to present the gift of the Class of 1931, celebrating its 40th reunion; it was the first class to graduate after Karl T. Compton became President of M.I.T. in 1930—hence the Class' invitation to Mrs. Compton as their spokesman. Her announcement was a total of $886,838, the gift of 345 members of the Class.

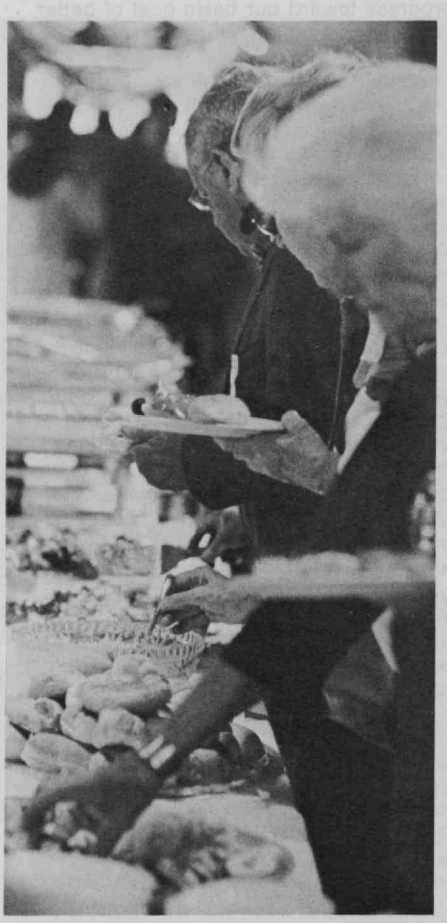
James S. Craig, Reunion Gift Chairman for the 25-year Class of 1946, brought a heavy white bag to the rostrum; its contents, he said: a reunion gift of $189,510, achieved by the participation of 353 members—over 70 per cent—of the Class.

"The Great Debate"

The single "great debate" about the role of science and engineering—and their institutions—in the modern world, for which 2,000 alumni returned to the Massachusetts Institute of Technology for "Homecoming" on June 7, turned out to be two debates: How can government and industry direct the forces of technology to the welfare of society as a whole? And is education for science and technology to be centered on fundamental principles or upon their applications and their effects upon the society by which they are used?

Alumni Homecoming highlights, top to bottom, left to right: Arthur Fiedler and the Boston Pops; greetings from Raymond E. Wilson, '12, to James R. Killian, Jr., '26, at the latter's reception; seven pioneering rowers of the Class of 1921 unveiling the class' gift to M.I.T.; an international buffet; Edward E. David, Jr., Sc.D.'50, Science Adviser to the President, joins the "great debate" while Paul E. Gray, '54, Chancellor, listens; and the fun of finding old friends . . . but the loneliness of looking for them. (Photos: Owen D. Franken, '68)





On the first of these questions, Leo Marx, Professor of English and American Studies at Amherst College, offered the depressing view that the free-enterprise system has outlived its effectiveness for a democratic society. For example, said Professor Marx, two business conferences were held simultaneously in New York in February, 1971: in one, Consolidated Edison was planning for summer brown-outs because power capacity could not be increased as fast as power demand; and in the other, a major advertising campaign for air conditioners, to consume still more power, was being planned. In industry, the decisions are made by marketing men; at the highest level of government, the goals are defined on the basis of global rivalry.

Against this kind of criticism, the free-enterprise system (properly informed and regulated) was defended by Robert Charpie, President of Cabot Corporation, and the case for public debate on technological choices was urged by Clarence H. Linder, President of the National Academy of Engineering. (Dr. Marx thought there was at present little point in explaining technical issues to the citizenry, who know, he said that they remain powerless anyway.)

Edward E. David, Jr., '47, White House Science Adviser, took a more hopeful view of the interactions of technology and society. Suggesting that people and institutions adapt best to such interrelationships when they are in fact participants in the contention, Dr. David urged that engineering schools must not stand aloof from the social issues with which technology is today surrounded. The problem, he said, is to produce students "with different motivations and attitudes than in the past."

Paul E. Gray '54, Chancellor of M.I.T., agreed. He proposed that "the pressing problems of society today cannot be resolved with technology alone; and it is also clear," Dr. Gray said, "that technology cannot be successful without social understanding." Hence Dr. Gray's call for greater emphasis on problem-centered research and "effective intellectual cooperation" across disciplinary lines. A major issue in engineering schools, he said, was to "reconcile the constraints of problem-centered research with the need in academic research for open-endedness."

Sir William R. Hawthorne, '39, Head of the Engineering Department of Cambridge University, was more cautious. The first responsibility of an engineer is to be a good engineer—to build bridges that stand up and make food that is nourishing. The engineer is not a social scientist, and no university can "encapsulate a lifetime of experience;" let it instead help its students to the more modest goal of fundamental understanding, relying upon its research—and not society—to define the unknowns to which these fundamentals are to be applied.

Jerome C. Hunsaker, '12, Emeritus Professor of Aeronautical Engineering at M.I.T., spoke from the floor to side with Sir William by noting that the professional qualifications of good engineers are the result of practical experience, not academic training. "Can't we find a better way to articulate the two?" was Dr. Gray's response.

The Obstinate Intellectual Generation Gap

The much-touted "generation gap" has stubborn intellectual dimensions, not just stubborn social ones: education and its goals are simply viewed in different terms by different generations.

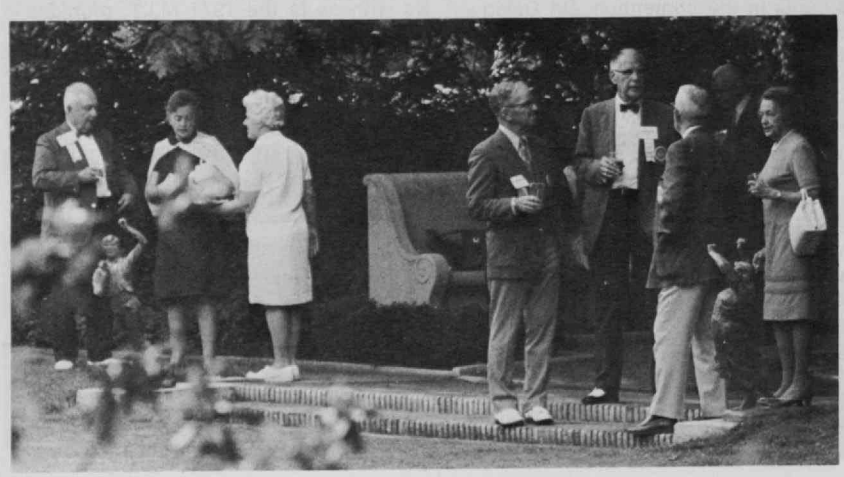
No witness to the 1971 M.I.T. reunions and Alumni Homecoming could have escaped the contrasts in outlook and priorities. Perceptive alumni surely left the campus feeling better acquainted—and perhaps more at ease—with the M.I.T. of today. But it would be illusory to think that all were won to the new ways they heard about.

"When I was hiring M.I.T. men," said one 50-year man sadly after the Saturday morning session on June 5, "I could be sure of what I was getting. A civil engineer was a civil engineer. Now you can't tell; I don't like it."

Bachelors in Diletantism

A modern engineering education is

M.I.T.'s Class of 1921 put on one of the liveliest 50-year reunions in memory in June. Among the highlights: Carole A. Clarke, Secretary, awarding Honorary Membership in the Class to President Jerome B. Wiesner (center, right); conversations with Warren K. Lewis, '05, Emeritus Professor of Chemical Engineering (top, right); and a reception at the President's House (bottom) by Mr. and Mrs. Howard W. Johnson.



not centered on learning formulas and handbooks. Its purpose is to develop self-sufficiency—"to bring the student to the point where he recognizes the need and has the ability to carry his education forward on his own initiative," Paul E. Gray, '54, Chancellor of M.I.T., told alumni attending campus reunions (*see above*) on Saturday morning.

Applications of engineering are increasingly seen in their social contexts, and engineering thus becomes interdisciplinary in nature. No single institution and no single educational plan can predict and fulfill all the requirements which will be made of today's engineer in his future professional career. And as M.I.T. broadens its interests in response to these conditions, it attracts a wider diversity of freshmen; so no single educational program is suitable for every student.

As Marvin A. Sirbu, Jr., '66, put it during later discussion, today's student "wants to be flexible, to avoid the box of being an expert in the wrong thing."

Are you supplying enough counseling asked an alumnus, a parent of a member of the Class of 1971 whose son thought the answer to that question was no. Emily L. Wick, Ph.D.'51, Associate Dean for Student Affairs, admitted the possibility. "The more flexibility, the more wisdom is needed to help students find their way to their goals," she said. "Is there ever really enough?"

You have an infinite number of courses, said another uneasy alumnus, and "I sense a tendency among students to duck the hard-core subjects" and look for the easy way out. Dr. Gray said he thought not: "All you can say is that this is not what's by and large happening."

Another suggested that the Institute may now be graduating Bachelors of Non-Disciplines, another—bringing laughter to the intense discussion—that the Institute's new degree was the Bachelor of Science in Diletantism.

"Give Them What They Want"

The divergent dialogue had begun on Commencement Day, when—at the luncheon following the graduation Exercises—Augustus B. Kinzel, '21, the founding President of the National Academy of Engineering, brought the message of 50 years' experience to M.I.T.'s newest graduates: "Never apologize for a job well done; satisfy your employer and give him what he wants at the price he wants to pay."

For half a century members of the Class of 1921 have been doing just that, he said: "We gave the public what it wanted within the limits of what it would pay." And in the process the public gained comfort and leisure, and the U.S. changed its definition of poverty. "We have nothing to apologize for," he said—not realizing, perhaps, that some in his audience were troubled and embarrassed by such a frank and narrow definition of social responsibility.

Speaking for the Class of 1971, Diane Feldman skirted a direct confrontation. But she told Dr. Kinzel and his classmates that M.I.T. and the nation it serves had changed, even in her four years of residence at the Institute.

"When we entered science was the key to the future," Miss Feldman said. But now scientists have been "cast as monsters of destruction;" and instead of learning how to serve society in Dr. Kinzel's way, she and her colleagues have learned that "there are no sacred institutions or values, that we must adjust to change." Perhaps what we have really learned in the last four years is how to face questions, she said.

Peace vs. Hope and Thrust

Alumni and faculty could easily agree on one point. Everyone was relieved to see and experience few outward signs in 1970-71 of the activist revolt which was so threatening to M.I.T. in the previous year. But simple rejoicing may not be the order of the day.

One reason for the decreasing activist noisemaking is that many students heretofore keenly interested and outspoken in political affairs have drawn inward. With relative peace has come a lessened sense of hope and thrust, said Kenneth R. Wadleigh, '43, Vice President of the Institute.

Later in the day, Jerome B. Wiesner, President of M.I.T., told the Class of 1921 upon being awarded its honorary membership that silence is not golden. "If we weren't trying so hard to improve our lot we wouldn't be confronted with problems. When chemists want a reaction to take place," he recalled, "they apply heat and generate turbulence."

Foresight for Tomorrow: Responses to Diversity

Summarizing the week-end's lessons—including those of "the great debate" (*see above*)—Jerome B. Wiesner, President of M.I.T., said the words are diversity and foresight.

"An infinity of cultures are now living simultaneously," he told the alumni on June 7; each person's perception of the world depends on his own experiences. But today's students are living in a world that we have chosen for them, and this may be the ultimate issue; "I could not put myself in their state of mind." he said.

Such an attitude is essential, said Dr. Wiesner, as we think about education for the future. Our goal must be not to convey our own experience but to "open their eyes, giving them a way to explore and understand for themselves."

What we're facing up to is the fact that this society, having made good its goal of bringing the fruits of technology to many people, finds the scale of life's processes not linear but exponential, and we are on the steepening part of the curve. Suddenly we are in a system that moves so fast that we cannot define problems before we have to deal with them. "The lesson here," said Dr. Wiesner, "is that we must be much more perceptive, sensing danger signals earlier. . . . These are the kind of intellectual problems to which our institutions must now give priority," he declared.

In an early-spring conversation with C.J.A.C., President-Elect Jerome B. Wiesner discussed his concept of the Presidency of M.I.T.—and of the issues which he thinks will most urgently claim his talents. "For any man who's trying to do his job seriously," said Dr. Wiesner, "the Presidency will always present an overload; it is a question of where you put the emphasis. I don't believe that he should abandon the academic matters in favor of all the others."

"Some Tough Questions to Answer"

What will M.I.T. be like under the new administration of Jerome B. Wiesner as President and Paul E. Gray, '54, as Chancellor, who take office just as this issue of the *Review* appears?

Dr. Wiesner doesn't expect things—at least for the present—to be radically different. "I'm not a President that has come in from the outside with a mandate for change," he told members of the Corporation's Joint Advisory Committee on Institute-Wide Affairs this spring. "I don't believe I have a mandate to tear the place apart and put it back together again," he said.

Yet Dr. Wiesner admitted that everyone's style is different, and "as time passes the Presidency will take on the mark of the way Paul and I like to work." And, he said, "We all feel we have a lot of things to improve and some tough questions to answer."

C.J.A.C.'s wide-ranging discussion with Dr. Wiesner may have done more than any other event since he and Dean Gray were designated for their new assignments to expose to the Institute community the interests, concerns, and priorities of its new President. Here are some of his comments in response to C.J.A.C. members' questions:

When President-Elect Jerome B. Wiesner (left) sat with members of the Corporation's Joint Advisory Committee on Institute-Wide Affairs (Gregory Smith, '30, Chairman—right) for three hours early this spring, he gave a remarkably comprehensive view of the ideas on which will be based his administration of the Institute. "M.I.T.," he said, "is a very special kind of school. We specialize in excellence in science and engineering, and social sciences. We're not a general university," he declared—and he gave no sign that he thinks the Institute should change its orientation.

On the President's priorities:
"Paul and I hope we can organize in such a way that we will maintain a substantial involvement in the academic things in which we've been interested. . . . We want to structure our activities so that we maintain a deep personal involvement in academic matters. . . . I have a lot of half-formed ideas which have been evolving for some time . . . about some alternate academic structures which would allow us to engage in interdisciplinary academic and research activities in more effective and less chaotic ways.

Thinking About Where We Are Going
"I suspect that at the moment our appetite for the things that we want to do is bigger than that which we can actually do; we keep seeing things that we would like to continue to be involved in, and I don't think that is realistic. . . . Ideally, it would be nice if the President did not have to be involved at all in day-to-day operations but could direct his attention instead to thinking about where we are going; to helping to bring about the new things we want to do; to helping kill the old things that we ought to give up; to helping find money; . . . and generally to making policy and letting the machine run itself. But I think that is not likely to happen.

"I regard myself as an activist, and my first job is going to be to force myself not to be one—to stand back and think more about the longer-range things.

"The load of the Presidency is pretty much a self-imposed but necessary load, which comes from the feeling that you should be available to anyone who wants to talk to you. It comes from your feeling that every time you're invited to a fraternity or dormitory dinner you should accept because it gives you a chance to understand what's going on, and the

pleasure of an involvement with students. It comes from the feeling that you should be very visible to the alumni, particularly in times like these, and from the feeling that the President has to be in evidence when we are trying to get $1 million from a company or a foundation."

"The financial picture is going to involve a good deal of our attention for the next year or two. . . . We are committed to understanding our finances in enough detail to form some judgment about the efficiency of our operations. . . . I would say that we have several more years of continuing financial pressure to work through. . . . In addition to tightening our belts and operating more efficiently, we will have to work harder on fund raising. . . . My own judgment is that the health of this institution depends a great deal on our ability to respond to some of the new academic and research programs which the faculty and students want to do, and I don't think we can take them out of our present resources.

On faculty appointments:
"The President and the Provost . . . have never made a decision to appoint a new faculty member or administrative person without considerable discussion between us. The President has reviewed every senior appointment that was made. . . . In the case of the tenure appointments made from the outside, Howard and I have talked to a candidate together. We have always been in agreement on the individual and on a decision to move in a given area.

Operating in a Different Mood
"I think the problem is going to be harder in the future. Up to now, the Institute has been in a growth period, which allowed us, with some restraint to be sure, to match faculty growth with graduate student growth. . . . The departments have been able to identify and attract new people as their interests have grown and to promote younger people as they've matured, and we've never had a destructive competitive situation—seriously competitive—between departments. That will probably not be the situation in the next five years.

"If our situation changes radically, we'll have to make more formal arrangements about priorities and resources. . . . It is very clear . . . that we are going to be operating in a different environment and mood, having to be more thoughtful and more careful about balance and about the future of young people. . . . We may have to eschew hiring very good senior people to give young people opportunities; we may have to give up many desirable people."

On faculty participation in administration:
"I do not know what the proper balance between faculty participation and administrative management of an institution is. . . . I think there has been a great increase in the consultation between faculty and administration as compared to a decade ago. It is probably not optimum yet. . . . On the other hand, I just don't believe you can run this kind of institution well with a town meeting. . . . I agree with Kingman Brewster that you should err on the side of administrative responsibility and accountability rather than on the side of so much delegation that you don't make the progress that you should because . . . there are so many conflicts to be resolved.

"You rarely ever completely resolve conflicts; you balance them. . . . Issues about goals, for example, involve honest differences, and the role of the President and administration is to find an appropriate balance of goals, resources, and so forth. The job is also to communicate well enough so that people understand that there has been an honest and reasonable effort.

"My impression has been that in this institution whenever there has been a real issue and the faculty were involved in its resolution we found a better resolution than if it was resolved arbitrarily. I think there are some issues for which this doesn't work because the time constraints are too short or the conflicting interests are such that you may never get them resolved. (I would make the same observation about student involvement.) There should be more input and more understanding of what goes on, . . . but I would not want to be just an errand boy for a faculty that ran the school through a town meeting, for example. . . . I myself would not like to see a process whereby the faculty made all the budget decisions."

On research management:
"One of the things that has puzzled me a lot as Provost, and what I think is an institutional failure, is how to encompass adequately the problem of urban research and urban teaching. We were very belated in recognizing that this was a problem—urban blight and social problems were with us long before we tried to do something about them. We had what was regarded as the best planning department in the country, but for a long time they were primarily interested in physical planning. Even when we began to see that there were other problems, M.I.T. did not become a leader in the field as we have done in a large number of scientific and technological fields.

"Throughout our history we can find large numbers of innovations which filtered into the society, including the very controversial Draper Laboratory projects. These were generally the creation of some person of great genius. Contemporary problems are much broader and much more difficult for one man to encompass. It took one great insight and a tremendous amount of work for Stark Draper to do the chain of things he's done. . . . I do not think that one great insight is going to solve our social problems.

"Most of the problems we're wrestling with so seriously and in which we are trying to involve the institution today are of this kind. I have been trying to invent institutional forms here to deal with these problems a little better. What I regard as our semi-failures of the times come about because of the complexity of the problem and because you can't say to one man, 'Here's your ball.'

"[The process of research innovation] is one of the most critical problems for this institution to get on top of: how to pick the challenging intellectual areas and move into them hard."

On academic opportunities:
"When I was an assistant professor I discovered that the great thing about this place was that one could do just about anything he pleased. If I had something I wanted to do, I could go to my department head and get permission to do it. . . . The reason this has been a great institution for me personally was that it provided me with . . . freedom.

Wisdom Is Not Always the Prerogative of Youth
"I wonder if young people still have such freedom; I have no way of knowing. I have the sad feeling that this is not true for a lot of people any more, but I'm the last person who can get a really good measure of it. Whenever a young faculty member has come to me and said that he had something he wanted to do and needed some help or resources, I've tried to get them for him. But I suppose that most faculty are afraid to speak up or don't think to come."

On students and academic decision-making:
"I feel that I have a pretty high stake in the community, and I think every faculty member does. Students have . . . a disadvantage in that they don't have much power to defend their stake, and I think they should have more voice. But I am not one of those who believe that wisdom always comes with youth, nor always with age: but experience is worth something. If we don't have a faculty which can be trusted to think about educational matters and make value judgments, then we ought to get a different faculty; this also applies to administration. . . . But we also tend to be conservative and being challenged and pushed is a good thing; but on the whole we know a bit more about education than the student, and we also know more about the academic substance that we are trying to teach. . . . I do not think there's a simple-minded answer to the question of who has the most at stake or whose voice should be heard more, the voice of the faculty or the voice of the students.

"I think the worst possible voice for the students is the kind of student government most universities have, which either deals only with unimportant problems or deals with important problems in a way that gives it no chance to do anything but talk about them. My own inclination is to believe that more and more student involvement in the ongoing academic committees is the way to amplify the student voice, and this is the way we've been moving"

Gregory Tucker, 1908-1971

Gregory Tucker, Professor of Music in the M.I.T. Department of Humanities, died on July 7 following a four-month illness; he was 63 and had been a member of the M.I.T. faculty for nearly 25 years.

John E. Burchard, '23, Dean Emeritus of the School of Humanities and Social Science, wrote to the *Review* of Professor Tucker, "That he was a more-than-competent musician was obvious to everyone who knew anything about him either as composer or as pianist. That he was a great teacher was clear to anyone who saw him act as teacher at any level.

"His enthusiasm was infectious, his sincerity obvious, and his demonstrations remarkably clear. So was his patience with the slow," wrote Dean Burchard.

In addition to his teaching assignments, Professor Tucker was Director of the Humanities Series, which brings outstanding chamber music to M.I.T. each year, and of Chamber Music at the Institute, in which assignment he organized countless less formal concerts by students, faculty, and local groups.

As composer, Professor Tucker wrote chamber music, pieces for ballet and modern dance, and other works. He appeared with such groups as the Juilliard Quartet and the New Music Quartet and as soloist with the Zimbler Sinfonietta and the Boston Pops.

Following study at the Combs Conservatory and the Curtis Institute in Philadelphia, Professor Tucker taught in Greenwich, Conn., and at Bennington College before coming to the Institute. He also held teaching assignments at the Longy School of Music, Harvard University, and Wellesley College.

"Are You Serious?"—A New Special Faculty Professor Wins Some Letters and Rights

Midway in the routine business of the year's last regular faculty meeting on May 19, E. Neal Hartley, Secretary of the Faculty, suddenly asked the presiding officer to relinquish the chair.

"Are you serious?" asked President Howard W. Johnson.

He was. The floor went to William T. Martin, Chairman of the Faculty, who presently introduced Robert M. Solow, Professor of Economics; addressing Mr. Johnson, Professor Solow said:

"Mr. President, sir, there's nothing about your job that's easy. Since this is the last regular meeting of the faculty over which you will preside, we could obviously not let the occasion go by unnoticed without some recognition of the particular part you've played in this little world over the last years. So the faculty has done two things.

"The first is this: a number of us have written you letters—we've done that before. These are rather different letters; some of them are short, some of them are long, but all of them are warm. And we've bound them together in an album here that I would like to give to you.

"I've looked at some of those letters. They're really very remarkable. There's not one of them that asks for an allocation of Institute funds. They do suggest that we all think that you've done a hard job very well and very gracefully and in the course of doing it—if I can coin a phrase—you've won the minds and hearts of the people.

"The second thing that we have done is a little sneaky. We tucked in at a special faculty meeting, held without your participation, another resolution. The faculty, at that meeting—with the concurrence of the Executive Committee of the Corporation, I'm glad to say—voted to establish the post of Special Faculty Professor, 'this professorship to be held by Howard W. Johnson from July 1, 1971, until he reaches the age of retirement, and then to lapse.

Everyone was surprised, but Howard w. Johnson most of all, when he was interrupted as presiding officer of the last Faculty Meeting of 1970-71 by Robert M. Solow, Professor of Economics. Professor Solow, noting that "there's nothing about your job that's easy," gave President Johnson a book of letters written to him by members of the faculty, and announced the faculty's secret resolution making Mr. Johnson a "Special Faculty Professor" whose duties will be "to lecture and teach courses as he desires and to be actively concerned with the welfare of M.I.T." In short, said Professor Solow, "we think you belong among us."

" 'The Special Faculty Professor will have the full rights and privileges of a regular member of the M.I.T. faculty. His duties will be first to lecture and teach courses as he desires and secondly to be actively concerned with the welfare of M.I.T. as an institution for education and research, to think about its problems and opportunities and to make his findings known.'

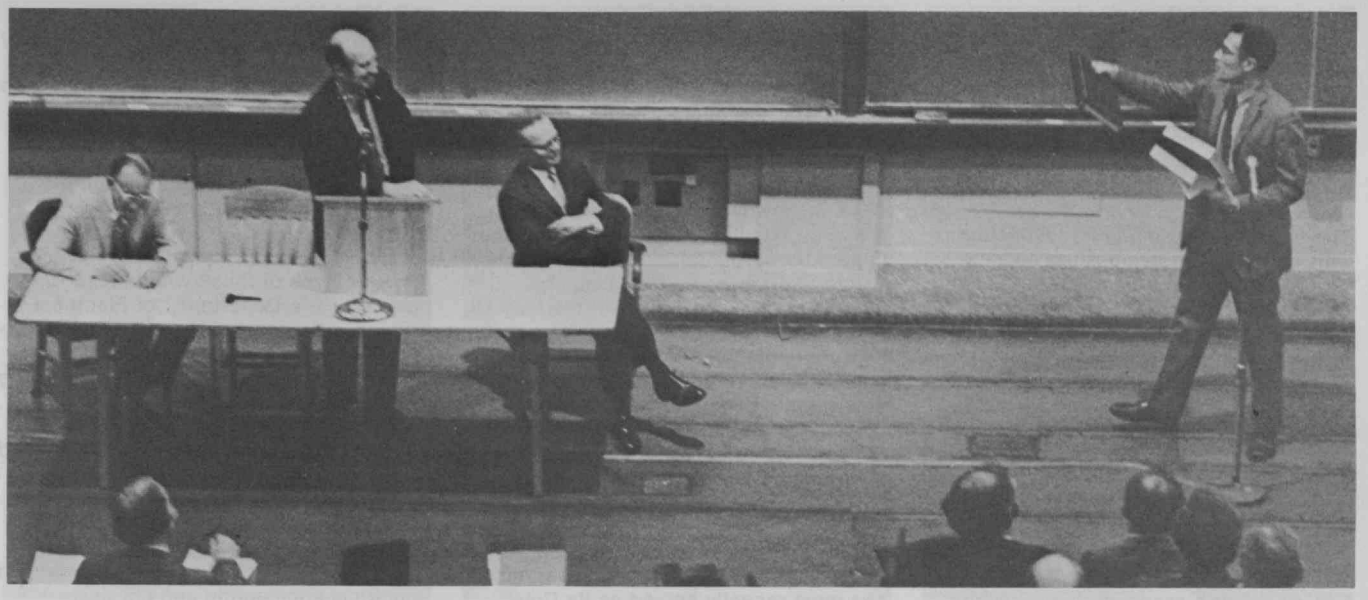
"In doing this, Professor Johnson, we wanted you to know that we think you belong among us, and we hope you'll stay among us for a long time; and we fear that you know too much about us to go running around loose."

"Compassion for the Human State"

After the standing ovation subsided, Professor Johnson returned to the rostrum with a statement of his own for his professorial colleagues:

"We share a precious heritage in this institution, and by my measures, the actions of this body have been outstanding. . . . We now regard these years as extraordinary. Only in the perspective of history will we really be able to measure what they were and what they have done. But my estimate is that in the light of history they will turn out to be even more extraordinary than we think now in terms of having changed, made more effective, moved more vitally the universities which are at the heart of our society. . . .

"On the whole, I think the ledger at M.I.T. is decidedly positive. These are the characteristics of this institution: that we are a vital place, responsive, interested, deeply involved with the world; that we are an open place—I believe more open; that we are performance minded, and we don't apologize for that; and that we combine a high principle with a real compassion for the human state. I think (these words) do sum up for me and, I believe, for you the course which we have followed during this time. I said more than five years ago now that M.I.T. has always looked forward as a maker of the future, and I beseech now your support for the new President and the new Chancellor."



Future Foods Symposium

Louis Rey, Scientific Adviser and Head of Corporate Research and Development for Nestle-Alimentana, S.A., Vivey, Switzerland, has been designated to receive the ninth annual Underwood-Prescott Award at M.I.T. on September 23.

The award will be made in connection with an afternoon symposium on new developments in food science at which Dr. Rey as well as two other experts—Arthur E. Humphrey, S.M.'60, Director of the School of Chemical Engineering at the University of Pennsylvania, and Bruce A. Drew, Research Associate in Applied Mathematics for the Pillsbury Co.—will speak. George C. Seybolt, President of William Underwood Co. which co-sponsors the award with M.I.T., and Paul E. Gray, '54, Chancellor of the Institute, will speak at an award luncheon.

The award and associated lectureship, given for distinguished contributions to food science, honor the memory of William Lyman Underwood, grandson of the founder of the Underwood company, and Samuel C. Prescott, '94, the first Dean of Science at the Institute. Together, Messrs. Underwood and Prescott in 1895 were the first to show that spoilage in canned foods was due to microorganisms and to establish time and temperature guides for their elimination.

Retirements: Inadequate Reports of Very Adequate Careers

Four members of the faculty and four members of the M.I.T. administration—in addition to James R. Killian, Jr., '26, Chairman of the M.I.T. Corporation, whose retirement is celebrated elsewhere in this issue of the *Review*—have announced plans to leave active posts at the Institute as of July 1.

They are Lawrence B. Anderson, M.Arch.'30, Dean of the School of Architecture and Planning; Dr. John W. Chamberlain, '28, Consultant in Surgery to the Medical Department; Frank H. Conant, Director of the Graphic Arts Service; Doris S. Evans, Director of Alumni Records; E. Lee Gamble, Ph.D.'32, Professor of Inorganic Chemistry; Truman S. Gray, Sc.D.'31, Professor of Engineering Electronics; Dr. Harriet Hardy, Assistant Medical Director; John T. R. Nickerson, '32, Professor of Food Technology; and Carl M. F. Peterson, '29, Director of the Physical Plant.

In recording below brief details of their careers and—elsewhere on these pages—tributes from their colleagues, the *Review* feels the same sense of inadequacy which Howard W. Johnson, President of the Institute, expressed when attempting to review their contributions to the Institute for colleagues on the faculty.

Dean Anderson first came to the Institute in 1929 as a graduate student; a year later he held the Institute's Master of Architecture degree and the 23rd Paris Prize, then considered the most distinguished of all student prizes. He returned to be Assistant Professor of Architecture at M.I.T. in 1933 following the term at the Ecole des Beaux Arts in Paris made possible by the prize; he became Head of the Department of Architecture in 1947 and Dean of the School in 1965. Meanwhile, he has conducted an active architectural practice as a partner in the firm of Anderson, Beckwith and Haible and has served on a number of architectural award juries. At the May 19 faculty meeting President Johnson spoke especially of Dean Anderson's "remarkable record" in teaching. "One thing you run into constantly with his former students is an expression of gratitude to Professor Anderson for the work he has done as a teacher," President Johnson said.

Dr. Chamberlain, for many years a key figure in the M.I.T. Medical Department, has most recently served as its Consultant in Surgery while conducting an active private practice. He first came to the Medical Department—then called the Department of Hygiene—in 1937 and in 1940 was named its Assistant Director; for many years thereafter he maintained an active role in managing the Department's services to M.I.T. students and faculty. Dr. Chamberlain studied at Harvard Medical School (M.D.'32), interned at Strong Memorial Hospital and Children's Hospital, and when he came to the Institute in 1937 had appointments at Children's Hospital, Cambridge Hospital, and Massachusetts Memorial Hospital and was Assistant in Surgery at Boston University Medical School.

Mr. Conant joined M.I.T. as a photographer—its first—in 1926, and has ever since then been in charge of the Institute's proliferating services in photography and reproduction which have been built into a major service enterprise. He was among the founders of the M.I.T. Employees' Federal Credit Union, and he has been a long-time member of the Association of College and University Printers.

Mrs. Evans came to the Alumni Association in October, 1937, and she has been keeping the Association's records of its members—former M.I.T. students—ever since. More recently—in 1959—she assumed more general management responsibilities, first as Assistant to the Office Manager and later (1963) as Office Manager. She will continue work in the Alumni Association on a part-time basis following retirement, with major responsibilities for nominating and election procedures and for new editions of the *Alumni Register*.

One of the first students to receive a degree for work in the Research Laboratory of Inorganic Chemistry at M.I.T., Professor Gamble has been a member of the M.I.T. faculty since his postdoctoral year at the University of Paris in 1933, and he has been a principal lecturer in the Institute's freshman chemistry course for the past 20 years. Professor Gamble is a native of Haymarket, Virginia, and studied at Washington and Lee University before coming to the Institute; he has been Master of Baker House for six years and served for two years as Visiting Professor and a member of the M.I.T. Advisory Committee to the Birla Institute of Technology and Science at Pilani, India, from 1968 to 1970.

President Johnson described Professor Gray as "one of those who helped to make M.I.T.'s Department of Electrical Engineering the modern, effective department it is today." Indeed, this has been Professor Gray's role ever since receiving his doctorate at the Institute, first as instructor and later as a member of the faculty, teaching both undergraduate and graduate students in electrical and electronic instrumentation. Born in Spencer, Ind., Professor Gray came to the Institute from the University of Texas, where he completed work for bachelor's degrees in electrical engineering and physics.

Dr. Hardy is widely known for recognizing and then studying in detail the beryllium disease to which workers exposed to that unusual metal were found to be subject. She is also known for work on the toxic effects of lead, benzene, cadmium, mercury, and cyanide—and for her development of occupational safety programs at M.I.T. which have become a model for laboratories and factories throughout the U.S. Trained at Wellesley, Cornell Medical School (M.D., 1928) and Philadelphia General Hospital (intern, 1932-34), Dr. Hardy was associated with Radcliffe College, Massachusetts General Hospital, and the Massachusetts Division of Occupational Hygiene before coming to M.I.T. in 1949; her retirement officially occurs in 1972, but she will be on a one-year pre-retirement leave at the Dartmouth Medical School in 1971-72.

A specialist in food microbiology, Professor Nickerson was born in Nova Scotia and first came to M.I.T. with the Class of 1932. He continued for S.M. ('34) and Ph.D. ('38) degrees in food technology and then for 10 years served as food chemist for the Birdseye Co., Hygrade Food Products, and the National Association of Frozen Food Packers; he returned to the Institute as Research Associate in 1948 and was appointed to the faculty in 1950. Professor Nickerson has made principal contributions to research on food irradiation as a means of preservation.

Mr. Peterson served in the M.I.T. Department of Mechanical Engineering following his graduation from the Institute, becoming Instructor in 1931 and Assistant Professor from 1939 to 1943. Meanwhile in 1938 he was appointed Assistant Superintendent of Buildings and Power, and he gave up teaching responsibilities to become Superintendent in 1944—a post he has held, under differing titles, ever since. Mr. Peterson has thus been in charge of the Institute's physical plant during the period of its great expansion from a single group of main buildings to the present 125-acre campus.

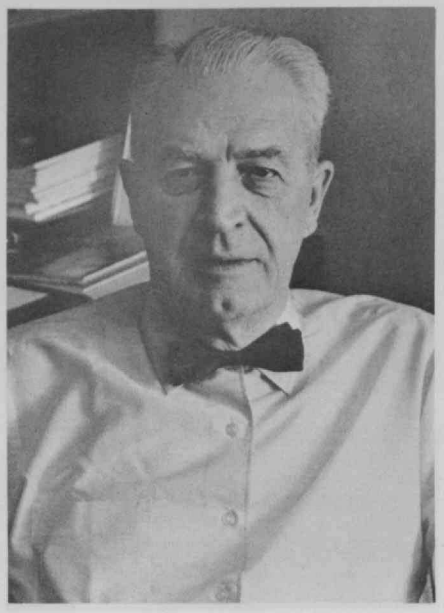
Lawrence B. Anderson, M. Arch.'30
Dean of the School of Architecture and Planning

Andy is the quiet, unobtrusive gentleman, courteous and sympathetic, who does not obviously push but who goes to the heart of the matter and manages to get a lot done. He can be sharp and cutting if necessary.

In my opinion, in architecture, he is a professional's professional. His philosophical insights are deep and mature; his grasp of the essentials of a problem is broad and sure. This is particularly evident in juries and critical evaluations of architectural problems and proposed solutions, whether by students or practicing professionals. His comments and judgments reveal exceptional understanding of the problem and perception of the strong and weak points of a solution. He is always ready with thoughtful analyses and suggestions. He will not compromise principles or subordinate sound aesthetics to flashy show.

His quiet manner and reticence have in some instances led students to the mistaken notion of a lack of interest or warmth. This notion is, however, quickly dispelled.

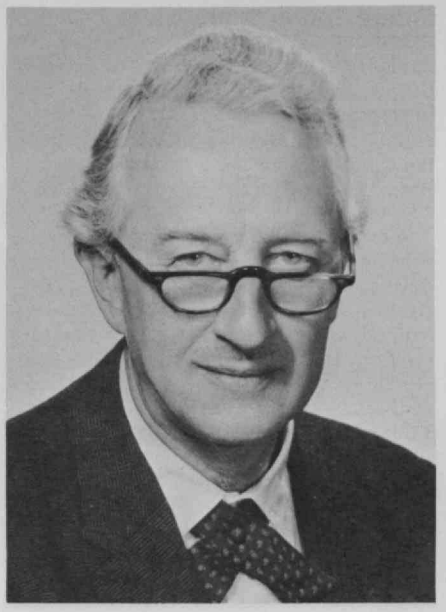
—Albert G. H. Dietz, '32
Professor of Building Engineering



Dr. John W. Chamberlain, '28
Consultant in Surgery
Medical Department

What could a Medical Director of M.I.T. want in his Chief of Surgery? First, he should be technically competent and have proved his competence by a good record in the operating room. Second, he should be a good diagnostician, knowing what he can do with his surgical skills and when to leave well enough alone. Third, he should inspire confidence in his patients by being appropriately confident in his speech and manner. Fourth, he should be able to achieve the respect of his colleagues and get along well with them. Fifth, he should have a sense of humor and the capacity to endure patiently the impatience of those whom he serves and with whom he works. Finally, he should be a man who would be welcome in any part of the Institute, enjoyed for his company, valued for his common sense, and not given to exaggerating his own importance. I had that in Jack Chamberlain for eight years. In addition, he was (and is) a personal friend at all times. What more could one expect?

—Dana L. Farnsworth
Director of the Health Service
Harvard University



Frank H. Conant
Director of the Graphic Arts Service

When the writer first came to M.I.T.'s News Service, its publicity files were replete with extraordinary photographs of M.I.T. from the air; it was when he asked about them that this writer first met Frank Conant, who turned out to have been both photographer and pilot responsible. No one who was aware of science in the 1930's can forget the photographs—many he made—of the great Van de Graaff generator installed in the hanger at Round Hill. Indeed, in these and many other ways Frank Conant may have been a pioneer in making good photographs to serve an institution's public relations.

When new technologies increased the use of photography in printing, Frank Conant moved quickly to keep M.I.T. abreast of the times. Indeed, he was so captivated by cameras, light tables, printing presses, and binding machines that he all but gave up photography to develop a broadly based graphic arts enterprise to serve all needs of M.I.T. There were times when, in consequence, the Graphic Arts Service tried too much —but many more times when without it the Institute would have been far less efficient and effective.

Clearly, few institutions have had a more comprehensive service in the reproduction arts; a corollary is that nowhere has there been a manager like Conant.

—John I. Mattill
Editor of Technology Review

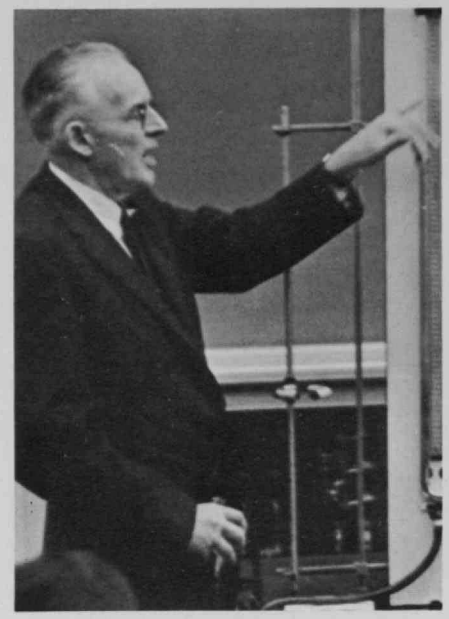
Doris S. Evans
Director of Alumni Records

No one at M.I.T. knows more alumni by name; no one has been more painstaking and more sensitive in personally keeping friends and classmates together at alumni occasions. None has been more understanding of alumni who forget to make advance registrations or who lose their tickets and even their tempers.

Mrs. Evans has been associated with our Alumni Records program for 34 years, and for eight years she has been in charge of this work and of the supporting activities; fortunately, her retirement does not mean immediate loss to M.I.T. of her vast knowledge of thousands of M.I.T. graduates, for she will continue on a part-time basis.

A significant segment of Mrs. Evans' career has coincided with change. The Alumni Fund began shortly after her arrival at M.I.T.; subsequently there were key roles in introducing the first, second, and third generations of computers to handle the Association's data processing and develop logistical support for 4,000 Association officers, solicitors, and other workers. No member of the Association staff has had to teach or supervise more changes throughout these developments. The ultimate compliment may be that Mrs. Evans has contributed a kindly, personal influence, and that it has always been a privilege to work with her.

—Donald P. Severance, '38
Executive Vice President
M.I.T. Alumni Association

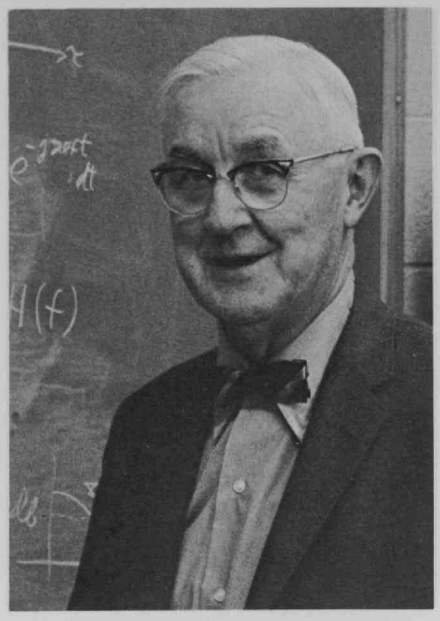


E. Lee Gamble, Ph.D.'32
Professor of Inorganic Chemistry

When we were neighbors on Memorial Drive, during his years as Master of Baker House, it used to be my good fortune now and then to walk to work in the morning with Lee Gamble. Those were memorable mornings. Never mind the whineysnarl of the inbound traffic, one might well have been strolling in any quiet college town in the country, for as he was met or overtaken by students, it was a constant chorus of matinal friendliness, all the way to Seventy-Seven, with every greeting answered in kind, a quip here, and quick remark there, a comment on work in hand, a question about common interests.

Professor Gamble's responses to those morning salutes were marked by a rare and subtle mixture of the avuncular and the fraternal, that blending of senior and contemporary which grows only out of respect for and appreciation of what it means to be young. I think this quality is the essential element in the complex of knowledge, study, ingenuity, address, and understanding that marks the true teacher. All the components of that complex served Professor Gamble and the Institute well during his years in charge of basic courses in chemistry, when his deep knowledge of the subject and his contribution to its development were noteworthy. Of them all, however, none was more called upon than his understanding of youth in his lectures to hundreds of students in 5.01 and 5.02, and I make no doubt that during his service in distant and different India the response of students to that subtle mixture equaled the liveliness and warmth that it had evoked at home beside the Charles.

—Frederick G. Fassett, Jr.
Dean of Residence, Emeritus



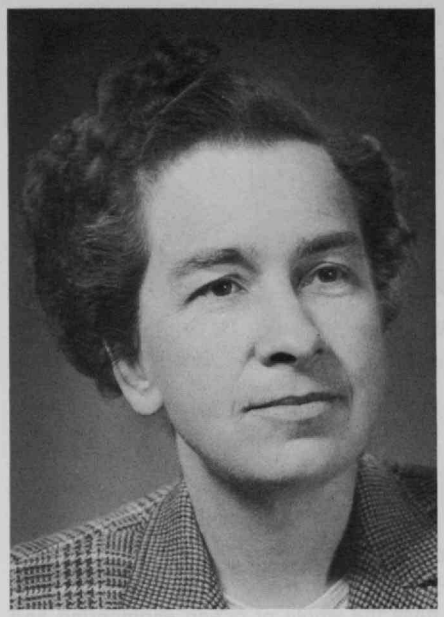
Truman S. Gray, Sc.D.'31
Professor of Engineering Electronics

Truman Gray, fresh from Texas, arrived in 1927 at M.I.T. to perform the duties of a research assistant in the Department of Electrical Engineering. I, too, had a similar appointment after having spent one year as a graduate student. We met at once, became fast friends and have continued to work together in various ways since that time.

Electronics was the thing to do in the 1920-30 period. Out of his work and from his teaching in this area came a textbook which has covered the world. Many students have been through the subject matter via this volume. Because of its completeness this book is still an authoritative text for the field of electronics.

An offshoot of the electronic book was Truman's teaching of the applications of electronic methods and associated techniques to measurement and control. At M.I.T., a succession of students from all over the Institute have met the subject through the well known course 6.20 "Electronics In Instrumentation," and Professor Gray's graduate-level course 6.632 "Electronic Instrumentation and Control," begun in 1934, is the only subject of that time still listed in the catalogue under its original instructor. There are other facets of Truman Gray's career. He is an effective expert in legal cases when his role is to educate the court as to technical details of the contention that is being litigated. He has spent some time in the rougher parts of Louisiana with geophysical crews. And his ability as a glassblower, as a silversmith, and as a clarinetist are to be noted.

—Harold E. Edgerton, Sc.D.'31
Institute Professor, Emeritus



Harriet L. Hardy
Assistant Medical Director

The scientific literature describes Harriet Hardy's major achievements in the field of occupational medicine, but it does not accurately reflect her contribution to the practice of occupational medicine or her almost missionary role as a vocal advocate of the patient with work-related illness.

It was from Dr. Hardy that hundreds of medical students and house officers in Boston hospitals learned to consider the possibility of occupational causation of disease and to obtain a proper occupational history. She taught prominent professors, delivering sermons and wagging her finger when necessary, and she adamantly opposed with success laboratory practices of doubtful safety.

The social problem of the patient with work-related disease never ceased to attract Dr. Hardy's attention. She was invariably perplexed and irritated by the predicament of the unsophisticated factory worker who was denied relief under workmen's compensation because his disease had not been officially "accepted" as occupational in origin and yet who could not obtain insurance benefits because his illness was occupational. She spoke out against current compensation benefits based upon a fraction of the disabled worker's factory wage level in the 1940's. She battled polished corporate lawyers who blocked awards she felt proper and obtained for her patients legal talent which could even the odds.

Harriet Hardy's colleagues and friends know that she will never cease to provide a public conscience protecting the unsophisticated against intimidation and opposing questionable public or private policy in matters of occupational health.

—Dr. Lloyd B. Tepper
Associate Director of the Kettering Laboratory
University of Cincinnati Medical Center

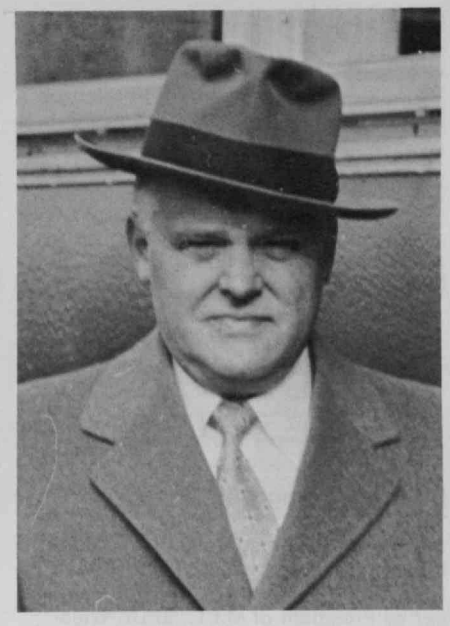
John T. R. Nickerson, '32
Professor of Food Technology

Dr. John T. R. Nickerson, has made a major impact on generations of students as a teacher and counselor since his arrival on the staff in 1948

From his years of experience in industry he has brought to the students a wealth of experience of industrial practice and technology. He has taught courses in food microbiology and food processing for many years. His research has dealt with frozen foods, radiation preservation of foods, and the sanitary quality of food products.

As a teacher his standard has always been that of excellence, and he transmitted this standard to his students. Former students returning for various reasons to the Boston area never fail to visit him, and his telephone is always busy with requests for help and guidance. And, as one of his former students said, "He is a man of unquestionable honesty and integrity."

—Samuel A. Goldblith, '40
Professor of Food Science



Carl M. F. Peterson, '29
Director of the Physical Plant

Carl Peterson will always be remembered by his associates as the complete physical plant man. The breadth and scope of his knowledge and expertise in this area never ceased to amaze. It ranged the field from horticulture to complicated utility rate structures to a thorough grasp of engineering and construction in all its aspects. It was obvious, too, that his abilities were recognized by a host of others outside M.I.T. A path was beaten to his door by people from all over the world seeking his counsel and advice. He became a veritable dean in his trade.

Not as visible, except to those who worked closely with him and to those whose responsibilities directly involved the long-term welfare of M.I.T.'s physical assets, was his wisdom and foresight in planning for the future. His decisions were not of the expedient variety, but rather involved hard thinking and planning for the long-term best interests of his beloved Institute.

What was visible was his no-nonsense, direct way of dealing with his responsibilities, all carried out in a style that can only be characterized as "inimitable". A strong and unique personality is leaving our midst. They "threw away the mold" in Carl's case.

—Philip A. Stoddard, '40
Vice President, Operations, M.I.T.

W. R. Dickson

D. Whiston

J. W. Coleman

A. A. H. Keil

N. Levinson

K. M. Hoffman

Informal Inaugural

Plans are now being developed for informal activities on Thursday, October 7, to mark the inaugural of Jerome B. Wiesner as President of M.I.T.; at Dr. Wiesner's suggestion, they will replace a formal, traditional investiture in the case of M.I.T.'s 13th President.

Preliminary plans call for a series of panels on topics relating to the contributions which M.I.T., as an institute of technology, is making and can make to resolving world scientific, educational, social, political and environmental problems in the 1970's, followed by a late-afternoon major address by Dr. Wiesner. There will be social activities in honor of Dr. Wiesner and Paul E. Gray, '54, Chancellor, during the evening. Alumni will be invited to participate in all these inaugural activities.

Operations Appointments

Retirements occasion three major new appointments in administrative service groups at M.I.T., effective July 1:

◇ William R. Dickson, '56, becomes Director of Physical Plant, succeeding Carl M. F. Peterson, '29, who is retiring *(see page 91).*
◇ Donald Whiston, '32, becomes Deputy Director for Plant Systems Development in Physical Plant.
◇ James W. Coleman becomes Director of the Graphic Arts Service, succeeding Frank H. Conant, who is retiring.

As Director of Physical Plant, Mr. Dickson will assume overall direction of the department, coordinating all matters pertaining to plant operations and maintenance, alterations to existing facilities, and the design and construction of new buildings. He graduated from M.I.T.'s course in Building Engineering and Construction and joined the Physical Plant staff in 1960.

Mr. Whiston—who, like Mr. Dickson, has recently been Associate Director of Physical Plant—will act as liaison with administrative and academic departments and will now direct a major review of the Institute's plant-related systems and procedures, giving special concern to technological change, environmental considerations, and cost effectiveness, according to Philip A. Stoddard, '40, Vice President—Operations, who announced the new appointments.

Mr. Conant's retirement comes 44 years after he joined the Institute to help found a photographic service, which he has guided into a multifaceted printing, reproduction, and photographic service to meet expanding university needs. Mr. Coleman, his successor, is presently Production Manager in the Graphic Arts Service; he came to M.I.T. in 1953 to work in the field of offset printing.

A Naval Architect Becomes Dean of Engineering

Alfred A. H. Keil, Head of the Department of Naval Architecture and Marine Engineering and a proponent of multidisciplinary education for engineering generalists, has been appointed Dean of the School of Engineering, succeeding Paul E. Gray, '54, who has become Chancellor and principal deputy to the President.

Dr. Keil becomes Dean of the School of Engineering—the Institute's largest school in terms of enrollment and faculty—at a time of growing concern with the relationships between technology and society.

In recent comments presented before the Commission on M.I.T. Education, Dr. Keil said the key questions the world faces are "how mankind can live with advancing science and technology, how it can be applied for the benefit of mankind, and in which areas are advances in science and technology particularly needed for the next decades."

One contribution M.I.T. can make during the rest of this century, he said, is "to substantially strengthen the opportunity for the education of multidisciplinary generalists who not only understand science and engineering, but also the interaction between advancing science and technology and the development of society, and who are motivated toward solving real-world problems."

Dr. Keil has been Head of the Department of Naval Architecture and Marine Engineering, the oldest academic department of its kind in the U.S., since 1966, and during that time its interests and activities have been expanded to encompass the whole of ocean engineering and utilization. New subjects have been added in such fields as commodity shipping, marine economy, and public policy in efforts to develop total systems perspectives for students.

Dr. Keil, a native of Germany, studied at Friederich Wilhelm University (Dr. Rer. Nat. '39) and worked in naval research for the German Navy during World War II. After the war he was associated with the U.S. Naval Technical Mission in Germany and in 1947 came to the U.S. for work in the Navy's Bureau of Ships. He was for 12 years Chief Scientist of the Navy's Underwater Explosion Research Division, later becoming Technical Director of the David Taylor Model Basin for three years before coming to M.I.T. in 1966. Dr. Keil holds the Gibbs Brothers Medal of the National Academy of Sciences, the Navy's Distinguished Civilian Service Award, and the Gold Medal of the American Society of Naval Engineering.

Ocean Engineering

As of April 2, the Department of Naval Architecture and Marine Engineering at M.I.T. has a new name: the Department of Ocean Engineering.

Alfred A. H. Keil, Head of the Department, says the name change reflects "the systematic broadening of the Department's scope." Through the Pratt School of Naval Architecture and Marine Engineering, the Department will continue to emphasize ship-related design; but there will now be "more varied applications of engineering for man's expanding use both of the ocean environment itself and of ocean resources."

Institutions Noteworthy

Asked by a Gallup survey to name the outstanding university in the world, a random sample of people listed in *The International Who's Who* picked Harvard first. Next, in order: Oxford, Cambridge, Princeton, M.I.T., and the Sorbonne.

Mathematics: Levinson and Hoffman to New Posts

Norman Levinson, '33, Professor of Mathematics who has been Head of the Department since 1968, has been named to the distinguished rank of Institute Professor, and he is being succeeded as Head of the Department by Kenneth M. Hoffman, Chairman of the Commission on M.I.T. Education.

Professor Levinson's distinction results chiefly from his research on linear and nonlinear differential equations, complex variables, and transform theory, and from his teaching in these fields at M.I.T. A theorem relating scattering phase and bound states in physics is named for him.

Professor Hoffman is principally known at M.I.T. for his work as Chairman of the Commission, but he is also recognized as an outstanding teacher, having taught subjects ranging from freshman calculus through advanced graduate courses since he joined the M.I.T. Mathematics Department in 1956. He was for one year Chairman of the Department's Committee on Pure Mathematics before undertaking the Commission assignment in 1969, and he is a leading authority on commutative Banach algebras.

Professor Hoffman holds degrees from Occidental College and the University of California (Los Angeles). Dr. Levinson was educated at M.I.T.—S.M. (electrical engineering) 1934 and Sc.D. (mathematics) 1935—and has been a member of the teaching staff since 1937, when he completed two years as a National Research Council Fellow at Princeton and the Institute for Advanced Study. He held a Guggenheim Fellowship in 1948 for study at the University of Copenhagen, and he holds the Bocher Memorial Prize of the American Mathematical Society (1953) and the Chauvenet Prize of the Mathematical Association of America (1971).

Occupation Inquiry Closed

Though the occupation of the offices of the President and the Chairman of the Corporation in January, 1970 (*see* Technology Review *for February, 1970, pp. 72A-72D*), "was conduct which is wholly intolerable in an academic community," the Committee on Inquiry specified by action of the M.I.T. faculty in November, 1970, has recommended that "no further investigation of the involvement of teaching staff in these events be undertaken."

The issue is thus closed, according to ground rules adopted by the faculty at the time the Committee on Inquiry was designated.

In making its recommendation, the Committee cited two considerations which seemed "decisive against a further specific investigation of the role of academic staff in the occupation:"

◇ The criteria for censure are such that "nothing short of an exhaustive effort" would have any significant result. There were "differences among the various representations made to the Committee with respect to the extent and intensity of academic staff participation," the report says, and resolution of these might be very difficult; indeed, "we believe that there is very little chance that further expenditure of time and energy on this matter would serve any constructive purpose," the Committee says.

◇ The faculty resolution of December, 1970 (*see* Technology Review *for February, pp. 82-83*), ensures due process in future cases and clearly defines "improper forms of protest activity," making the use of the January, 1970, case unnecessary as establishing a precedent.

Given these factors, says the Committee on Inquiry, "we believe that the faculty can and should now . . . direct its energy to the future."

Mathematics Winners

Three undergraduates representing M.I.T. as a team have won second place in the 1970 William Lowell Putnam Mathematics Competition, and a fourth student has placed fourth among individual contestants in the competition.

The M.I.T. team, which placed second to the University of Chicago, was composed of Don Coppersmith, '72, Steven Winker, '72, and David Christie, '73. In addition, Mr. Coppersmith placed second in the Putnam individual competition, Jeffrey Lagarias, a graduate student, placed third, and Mr. Winker placed sixth. Team members received $75 awards and individual finishers received $250; the M.I.T. Department of Mathematics received $400 in commemoration of its students' success.

Eight New Members for the Largest Corporation Ever

Eight new members—five of them in the new category of "Representatives from Recent Classes"—were elected to the M.I.T. Corporation at its meeting on June 4, two members were re-elected to new terms, and one—James R. Killian, Jr., '26—was elected to Life Membership upon his retirement on July 1 as Chairman. As a result of the elections, the Corporation is now larger than ever before in M.I.T. history.

The new members are:

◇ Paul M. Cook, '47, President of Raychem Corp., Menlo Park, Calif.
◇ William S. Edgerly, '49, Financial Vice President of Cabot Corp., Boston.
◇ James A. Hester, '65, Senior Analyst, Office of Programs and Policy, Housing and Development Administration of New York City.
◇ Christina H. Jansen, '63, M.I.T. graduate student in metallurgy.
◇ Kenneth H. Olsen, '50, President of Digital Equipment Corp., Maynard, Mass.
◇ Michael V. Sawyer, '71, who will enter Princeton University in September.
◇ Laurence Storch, '71, who will enter Harvard Law School in September.
◇ Pamela T. Whitman, '70, teacher at the Industrial School for Boys, Shirley, Mass.

Dr. George W. Thorn, Physician-in-Chief at Peter Bent Brigham Hospital and Levine Professor of Medicine at Harvard, was re-elected to a five-year term, and Paul V. Keyser, Jr., '29, former Executive Vice President of Mobil Oil Corp., was re-elected to a one-year term (ex-officio) as re-elected President of the M.I.T. Alumni Association. Dr. Killian's election as Life Member confirms his continuing participation in the Corporation of which he has been Chairman since 1959.

Of the new members of the Corporation, the five in the category of "Representatives from Recent Classes"—Mr. Hester, Mrs. Jansen, Mr. Sawyer, Mr. Storch, and Miss Whitman—were nominated in a special ballot circulated to all alumni receiving M.I.T. degrees since January 1, 1969. They will serve for staggered terms ranging from one to five years, and a new election will be conducted among recent graduates in 1972 to fill the first vacancy. The other new members were nominated in a national balloting of all alumni.

Mrs. Jansen and Miss Whitman become the second and third women to be members of the M.I.T. Corporation; Mrs. Philip Wagley, '47, Headmistress of St. Paul's School for Girls, Baltimore, was elected to a five-year term last year.

Mr. Sawyer and Mr. Storch are both 21, but Mr. Storch—younger by a few weeks—becomes the youngest person ever to serve on the Corporation.

Mr. Sawyer is the third black ever elected to the Corporation; the others are Jerome H. Holland, U.S. Ambassador to Sweden, elected in 1969, and the late Whitney M. Young, Jr., Director of the Urban League, elected in 1970.

Mr. Hester studied aeronautical engineering for S.B. and S.M. degrees and then switched to city planning for his Ph.D. (1970). As an M.I.T. student he was a member of the Planning Group for the M.I.T. Commission on Education and of the Policy Committee for the M.I.T.-Harvard Joint Center for Urban Studies. Mrs. Jansen, who is a candidate for the doctorate in metallurgy at M.I.T., has been involved in many M.I.T. activities as well as community and professional affairs. Mr. Sawyer, active in M.I.T.'s Black Student Union as well as musical and athletic activities, received bachelor's degrees in physics and mathematics on June 4. Before he transferred to M.I.T. from Carnegie-Mellon University in 1969, Mr. Storch had been a member of that University's History Department Curriculum Reorganization

	Graduate school	Academic research	Industry	Government (Civil Service and Army)	Cannot find a job	No definite plans	Not reporting yet
S.B. Engineering	54	1	18	8	13	5	47
S.B. Science	77	1	4	4	7	7	50
S.M. Engineering	40	4	26	12	4	3	38
S.M. Science	72	7	—	7	7	7	55
Ph.D. Engineering	(teaching) 6	21	33	11	15	5	10
Ph.D. Science	14	(post doctoral) 57	2	4	12	4	15

As summer began, the M.I.T. Placement Office began to tabulate the 1971 graduates' plans for the year ahead. The numbers who report plans for graduate school and those who say they "cannot find a job" are higher than in recent years, but Robert K. Weatherall, Director of the Office, says that final conclusions are premature.

Committee; at M.I.T. he has been a member of the Commission on M.I.T. Education and has taken part in many discussions of activism and campus change. Miss Whitman's M.I.T. major was in humanities and science, and she was President of the Senior Class, a student teacher at Rindge Technical High School in Cambridge, and a participant in many undergraduate activities.

Jobs: An Unaccustomed Struggle

In 1953, Technology Review reported that that year's graduating class "left M.I.T. with professional opportunities in science and engineering unequalled by any class in the history of the Institute." Today, less than 20 years later, it's different: M.I.T.'s graduates face a more hostile job market than have any of their recent predecessors. Nevertheless, the Class of '71 is holding its own—almost.

Of recent graduates responding to a survey by the M.I.T. Placement Office, only 7 per cent of the S.B.'s in science and 13 per cent of the S.B. engineers have reported that they are unable to find jobs. Another 12 per cent of the S.B.'s have admitted to still being unsettled, but have not yet said they just could not find a job.

Robert K. Weatherall, Director of M.I.T.'s Placement Office, reports that fewer members of the Class of 1971 came to his office looking for jobs this year than did the Class of 1970—200 less. He thinks students are trying to stay out of the job market for a while, noting that graduate school is a more popular alternative this year than it has been since 1968 when Uncle Sam stopped giving draft deferments to graduate students. Medical and law schools are particularly popular with this year's graduates.

The activities of recruiting agencies were also slower this year than last. This year only 190 companies came to the M.I.T. campus to interview applicants (29 per cent of those who planned to come cancelled); last year 256 companies sent recruiters to M.I.T. Indeed, the number of companies interviewing at M.I.T. has dropped steadily since 1966-67, when 412 eager potential employers interviewed almost 700 new S.B. graduates. This year 294 S.B. graduates had interviews.

There has been a similar trend in recruitment by government agencies. From a high of 40 or more between 1967 and 1969, only 26 government agencies recruited on campus this year. But graduate schools reversed this trend. Perhaps sensing that this was "their year," 21 graduate schools sent recruiters onto the campus—more than in any of the previous five years.

According to Mr. Weatherall, a student who thinks he knows what he wants and is personable has a good chance of going out and getting it. But this requires a kind of aggressive pursuit unnecessary in years past. Students having the hardest time, he says, are those who have not related themselves to what the outside world will expect of them. Many—indeed, more than in previous years—seem unsure of what they want to do, and of what it may be useful to do in terms of social benefit. Students continue to look for jobs in the "glamour" fields—not thinking enough, he thinks, of the engineering needs of basic industry. They are also wary of large corporations, for they want to be valued as individuals. They fear that in a big company they will be small cogs in a piece of large machinery, preferring to be big—or at least individual—fish in a smaller pond.

SCORE Corporation

Paul E. Gray, '54, Dean of the M.I.T. School of Engineering, has joined with colleagues from seven other major American universities to form a new non-profit corporation to encourage student-initiated competitions which advance engineering education.

The corporation is SCORE, for Student Competitions on Relevant Engineering. Its founding is largely an outgrowth of the success of last summer's Clean Air Car Race.

Engineering deans and administrators from Tufts University, Dartmouth College, the University of California at Berkeley, Carnegie-Mellon University, the University of Michigan, the University of Wisconsin and Georgia Institute of Technology as well as M.I.T. participated in launching the new corporation.

Membership in SCORE will be open to any institution which awards bachelor's degrees. Officers and active members in SCORE will be students, but the board of directors will be made up of administrators from member colleges. The annual membership fee will be $100 per thousand enrolled engineering undergraduates.

As its first venture, SCORE is working with the coordinating committee of the Urban Vehicle Design Competition, a group of students from Boston area colleges, located at M.I.T. (*see* Technology Review *for June, p. 67*). The event will test cars designed and built to solve the special problems of city driving. More than 90 groups have already expressed an interest in participating in U.V.D.C., which is scheduled for the summer of 1972.

At a press conference this spring, Alfred E. Vellucci (right), Mayor of Cambridge, said M.I.T. "has finally come to realize they are a part of Cambridge and must realize the responsibility of being part of such an urban community." The occasion was the announcement by the Department of Housing and Urban Development of final approval for M.I.T.'s plan to build under a turnkey program 684 housing units in various parts of Cambridge for elderly residents; upon completion the units will be acquired by the Cambridge Housing Authority and M.I.T. reimbursed for its full cost. Left to right, with Mayor Vellucci: Daniel F. Burns, Executive Director of the Cambridge Housing Authority; John F. Clinton, Director of the Cambridge Housing Authority; M. Daniel Richardson, Jr., Boston-area Director for the Department of Housing and Urban Development, and Howard W. Johnson, President of the Institute. (Photo: Ronald Donovan, Boston Herald-Traveler)

M.I.T. and Cambridge Housing: The Nation's Largest "Turnkey"

M.I.T.'s plans for the development of public housing on three widely separated sites in Cambridge have been accepted by the Cambridge Housing Authority and the Department of Housing and Urban Development, and construction is expected to begin in September. It is the largest "turnkey" program thus far approved by H.U.D., and H.U.D. believes it is the largest public housing development and apparently the first turnkey project ever to be sponsored by an educational institution.

The total cost for 684 units will be over $17.5 million. Under the "turnkey" program, the Cambridge Housing Authority will purchase the structures upon their completion by M.I.T. and will then operate them as housing for elderly residents. H.U.D. will finance annual subsidies to maintain rents at a specified figure and will make preliminary loans for planning and construction.

President Howard W. Johnson emphasized at a H.U.D. press conference announcing the final agreements that "M.I.T. has just put the money on the table; there is no profit and no loss." The Institute's advances—already almost $2 million for land costs and architectural fees—will be returned in full when the projects are completed and turned over to the Cambridge Housing Authority. "We are proud," President Johnson said, "to have had the opportunity to provide this type of facility in Cambridge."

The final key decision on the plans came early this spring, when the Cambridge Housing Authority—pressed by several competing if incomplete proposals for housing—selected M.I.T. "as the developer whose proposal best met the needs of Cambridge," M. Daniel Richardson, Jr., Boston-area H.U.D. Director, told the press conference. "Further," he added, "it should be noted that M.I.T worked closely with H.U.D. in refining the design concepts not only to meet but to exceed federal standards."

The 684 units—studio and one-bedroom apartments—will be built on sites acquired by M.I.T. at Clarendon Avenue in North Cambridge, Gore Street in East Cambridge, and Hamilton Street near Pearl Street in Cambridgeport. They are part of the comprehensive program for improving housing in Cambridge first announced by M.I.T. in April, 1969 (*see* Technology Review *for May, 1969, pp. 75-76 and 86*) which eventually contemplated some 1,600 units of low- and medium-income housing.

Daniel F. Burns, Executive Director of the Cambridge Housing Authority, said at the press conference that when completed the 684 "turnkey" units would be made available "to elderly persons 62 years of age and over whose incomes meet the limits set by the authority. In no event will a tenant pay more than 25 per cent of his income for rent."

The three sites are at present either vacant or occupied largely by defunct industrial buildings. The new "turnkey" structures are being designed by Benjamin Thompson and Associates, architects, of Cambridge; they will help to relieve a major shortage of low-cost Cambridge housing caused in part by the pressure of M.I.T. students and staff.

Kispert: Institute Secretary

Malcolm G. Kispert, '44, who has for 10 years been Vice President, Academic Administration, of M.I.T., has been appointed to the new post of Institute Secretary where he will have special responsibilities for a major effort to secure increased scholarship and loan funds for M.I.T. students.

Mr. Kispert's new post is "organized to serve as the focal point of an intensified effort to augment the Institute's financial resources from private individuals capable of making important contributions to M.I.T.," according to the announcement from Howard W. Johnson, Chairman of the Corporation.

As an undergraduate in aeronautical engineering, Mr. Kispert won the coveted William Barton Rogers Award for high scholarship, character, and leadership in student affairs; he joined the M.I.T. administration upon completing military service and since then has served in various positions under four Presidents of M.I.T.

Can There Be Energy For the Future We Seek?

After nearly seven hours of papers on energy supply, demand, and resources on Saturday, May 1, alumni attending the seminar on "Providing Energy for the Future" were fairly satisfied that any reasonable energy demand for well into the twenty-first century could be met through the advance of technology.

If fossil fuel resources were insufficient—a possibility suggested for the long-term by Dayton H. Clewell, '33, Senior Vice President of Mobil Oil Corp., and Morris A. Adelman, Professor of Economics at M.I.T., the prospects for nuclear fission and fusion have never been brighter, according to Edwin C. Kintner, S.M.'46, Assistant Director of Reactor Engineering for the U.S. Atomic Energy Commission, and David J. Rose, '50, Professor of Nuclear Engineering at M.I.T. And there are also promising developments in gasification of coal for electric power applications, according to Hoyt C. Hottel, S.M.'24, Professor Emeritus of Chemical Engineering, and Arthur M. Squires, Head of the Department of Chemical Engineering at the City University of New York.

Then came Jay W. Forrester, S.M.'45, Professor of Industrial Management, to ask the shocking question: Do we really want more power? And if so, how much?

Professor Forrester outlined the methods which he has developed in the Sloan School of Management—system dynamics—and described work for the Club of Rome to analyze what he calls "the counterintuitive behavior" of world systems (*see* Technology Review *for January, 1971, pp. 52-68*).

"Though we have never had a higher standard of living, we think there is a crisis," he said, "because our expectations are higher than our achievements. It is at the peak of any curve that the divergence of hopes and reality is highest. We have many expectations of technology, but we have from technology more problems than solutions." Indeed, he said, "we are at the point in our society where essentially every technological advance has the effect not of solving but simply of shifting the problem in time or space.

"No technological solution really solves anything," he declared.

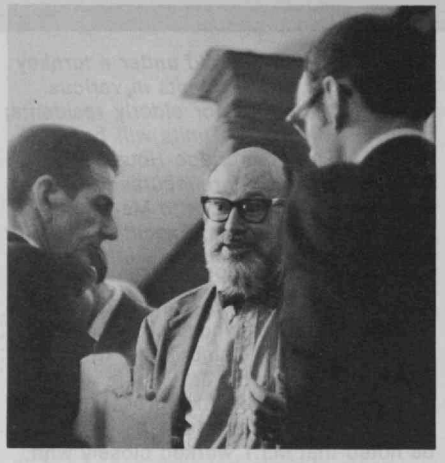
By Sunday morning seminar members were ready for reassurance—of which they received small measures from Henry G. Houghton, S.M.'27, Professor Emeritus of Meteorology, on the world heat and energy balance, and from William W. Lowe, Partner in Pickard, Lowe and Associates, on power plant siting and construction.

But it remained for David C. White, on Sunday afternoon, to propose a system analysis of the electric power generation and consumption, in which all the factors of increasing population, increasing dependence on electricity, decreasing fossil fuel resources, antipollution requirements, capital needs, and fission and fusion technology might be interrelated. Already Professor White and Martin Bothman, a graduate student in electrical engineering, have developed a 100-variable model of the present energy system, but this is only the beginning of what they believe should be a major M.I.T. research effort.

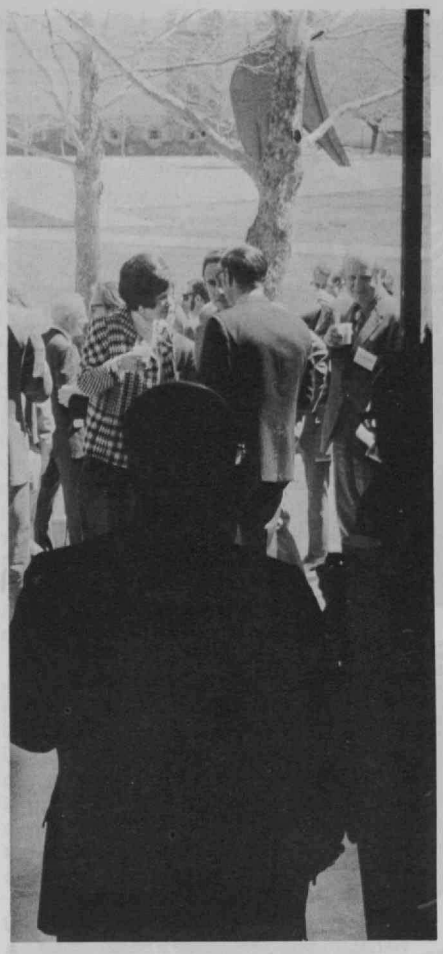
In the short run, Professor White said, power shortages and even occasional crises are hardly avoidable; projections of growing power consumption simply require capital investment at a rate higher than capital is now assembling. Time delays between conception and completion of a major generating station are now so great that today's decisions cannot be effective in time to solve the problems we now perceive.

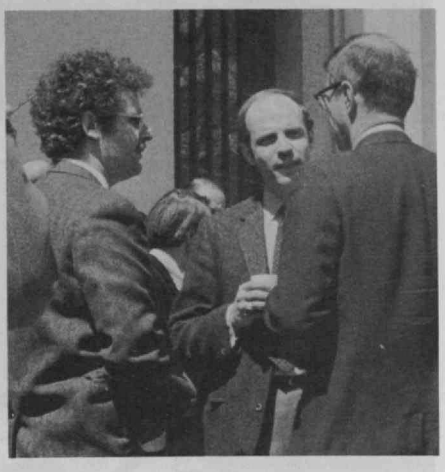
During the discussion period following, Professor Hottel recalled that throughout his career on the M.I.T. faculty he has been promising himself—and his students—that the exponential rate of energy consumption would end "in about 15 years." He has been wrong every time—so far. "But I cannot help feeling that it's now time to question the validity of the principle that growth is always a good thing," said Professor Hottel. "Is energy per capita really a good measure of the quality of our life?"

His comment inspired Professor Rose to the rhetorical question, Does our educational system now prepare young people to understand these issues, to deal with our real problems? For himself, he answered, no.



Raw energy is now something over 4 per cent of the U.S. gross national product, and energy consumption has been rising faster than most g.n.p. components. Where it will end was the unanswerable question when nearly 100 alumni returned to Cambridge in May for a two-day seminar on "Providing Energy for the Future." Among the principals at the concluding panel (top) were (left to right): Hoyt C. Hottel, S.M.'24, Emeritus Professor of Chemical Engineering; Arthur M. Squires, Professor of Chemical Engineering at C.C.N.Y.; William W. Lowe, Partner in Pickard, Low and Associates; David J. Rose, '50, Professor of Nuclear Engineering; Morris A. Adelman, Professor of Economics; Edwin E. Kintner, S.M.'46, Assistant Director of Reactor Engineering in the A.E.C.'s Division of Reactor Development and Technology; and David C. White, Ford Professor of Engineering. The keynote address by Jay W. Forrester, S.M.'45, gave some seminar members a sleepless night with forecasts of increasing pollution and decreasing resources.





Spring sunshine competed (mostly without success) for the attention of more than 100 alumni attending the seminar on "Engineering Opportunities in the Health Care Industry" in April in Cambridge. The advice: don't be discouraged. Like the electric power industry (opposite), the health care business tends to be conservative; what's being done works for those it serves, and everyone is reluctant to make changes. But there is no "medical-industrial complex" to crack, said Peter Felsenthal, '54, of the Cleveland Clinic; everyone—including the new engineer who wants to make a start—is on his own.

Engineer vs. Doctor— How Soon Can Peace Come?

Behind the truism that people are not quite like instruments lie most of the frustrations that keep engineers and doctors at an uneasy truce when they try to bring one's expertise into the other's discipline.

If that sounds like the same old record replayed again, take note: the players in this particular performance were M.I.T. alumni, returned to Cambridge late in April for a two-day seminar on how engineers can contribute to the health care industries. They were mostly young people—an even distribution, approximately, between engineers and physicians. So the dialogue had some hopeful turns.

In his introduction, Peter Felsenthal, '54, of the Cleveland Clinic warned his audience that health care institutions tend to be conservative: what is now being done works, and this being so everyone is reluctant to make changes. These institutions know, too, that the practice of medicine is more art than science; engineers like to work with analytical systems while doctors are used to multivariant problems.

Hospitals represent highly departmentalized structures in which every unit is out to preserve its prerogatives, said Mr. Felsenthal. And no wonder, he said: everyone is highly trained in his specialty, and such "outsiders" as engineers seldom share in the emotional make-up which results from the combination of medical training and practice. With life in his hands, said Mr. Felsenthal, it is no wonder that the doctor has a "God complex." He has no "feeling" for instruments, except that they should be as simple as possible; he wants to maintain his self-image as physician, and he uses all kinds of devices—including an unnecessarily specialized vocabulary—to do so.

Several physicians in his audience yelled "Foul!" as Mr. Felsenthal finished, and thereafter the dialogue never really ended—though there were moments of almost lethargic calm between eruptions during the next 30 hours.

Following an afternoon devoted to the applications of specific engineering techniques and equipment to medical practice, Edward B. Roberts, '57, Professor of Management at M.I.T., gave one of the ultimate examples: the use of systems analysis to study possible responses to such a complex medical-social problem as narcotic addiction. The system described as "industrial dynamics," developed by Jay W. Forrester, S.M.'45, Professor of Management at M.I.T. (*see* Technology Review *for January, pp. 52-68),* reveals that the behavior of many social problems is in fact counter-intuitive. Drug abuse turns out to be one of these, said Professor Roberts; for example, you may reasonably think that the way to reduce drug addiction is to reduce the supply of illegal drugs by increased police action and increased punishment of offenders. But Professor Roberts' analysis—based on computer models involving as many as 300 variables—reveals that enforcement will simply result in scarcity, higher prices, and more illegal traffic because there is more profit—as well as more risk.

Instead, the most promising solution emerging in Professor Roberts' analysis to date is a combination of several coordinated policies: increased police surveillance combined with programs of education for young people and parents and programs of withdrawal for addicts themselves.

Such analyses of counterintuitive systems represent a major potential contribution of engineering to the health care system; they are possible because of the engineer's ability to use computers and thereby manipulate large quantities of data quickly and economically. It is skills such as these, Professor Roberts said, which have made M.I.T. alumni so successful in many fields of management; they can expect to be equally successful in management applied to health care.

Other speakers during the week-end suggested a host of other fruitful interfaces for engineering and medicine—instrumentation, biomaterials (the particular concern of Allen Latham, Jr.; '30, President of Cryogenic Technology, Inc.), computers (Walter Menning of the International Business Machines Corp. and the seminar chairman, Dr. Jerome H. Grossman, '61, Assistant Director of the Laboratory of Computer Sciences at

Massachusetts General Hospital), clinical equipment, and multiphasic screening techniques. The topics may have lacked originality and all the old battle cries have been repeated; but for both sides of the perennial argument it was a new chance to think and talk toward a reconciliation which everyone agrees must ultimately come.

Environmental Laboratory

A new interdepartmental effort to focus and stimulate mission-oriented research on issues relating technology to environmental problems is now being developed at M.I.T.

Though its organization and funding are far from complete, the new M.I.T. Environmental Laboratory is already the catalyst for a study of national energy demands—and how they may be met—between now and the year 2000. The result will be a new set of estimates of energy requirements, comments on the prospects for controlling U.S. energy consumption, and recommendations for federal and industrial actions.

The project is typical of those which the M.I.T. Environmental Laboratory will be designed to tackle, according to Raymond F. Baddour, Sc.D.'51, Head of the Department of Chemical Engineering. It involves political, social, economic, and legal aspects, as well as the "primary ingredient" of technology.

"The future for this kind of activity at M.I.T. is bright," Professor Baddour told the Alumni Advisory Council this spring, reporting as its Director on plans for the Laboratory; the Institute is uniquely able to handle such very complex problems with so many different inputs, he said. "While it will be inappropriate for the Environmental Laboratory to make policy, its role will be to provide information for policy-makers, to point out policy options and the possible results of those options."

Funding remains a major roadblock, Professor Baddour admitted. It is hard to identify the client for an environmental research since we are all the client, he said; it is hard to define the projects to be studied; and "there is some question of what you do with a solution to an environmental problem once you find it." Indeed, he said, some plan for placing the solution into hands that can make effective use of it must be part of the most original problem definitions.

A definition of environmental problems and priorities may in fact be one of the Laboratory's first major goals, Professor Baddour said. He anticipates funding at the level of $1 to $2 million annually when the Laboratory is fully developed, but he admits that no such level of work will be likely by the end of 1971-72. Professor Baddour is optimistic: M.I.T.'s past record proves that the Institute can meet the requirement for "stringent reliability and credibility."

Sports—The Year of the "Well-Rounded" Athletes

Several trends in M.I.T. athletics have combined to produce both generally successful varsity teams and increased casual athletic activity throughout the 1970-71 school year despite financial pressures.

M.I.T. varsity sports have continually improved in quality despite a small drop in participation. Though M.I.T. is a relatively small school, it sponsored 21 intercollegiate varsity sports, more than any other American university. Last year, the pistol team won the National Pistol Championship. It was the first national win by an M.I.T. team since the sailors swept the 1961 nationals. The varsity teams in fencing (10-3), rifle (19-3), wrestling (10-6), gymnastics (6-2), swimming (7-6), sailing (18-14), lightweight crew (6-2), baseball (7-5), lacrosse (7-6), and track (3-1) also had winning seasons.

John G. Barry, Assistant Director of Athletics, says that "our teams' quality has been maintained at a high level and is improving despite a slight drop in varsity participation." Barry attributes the drop in participation to a number of factors, including N.C.A.A. rulings that allow freshmen on varsity squads and a desire by athletes to be "more well-rounded."

David Michael, Assistant Professor of Athletics who is intramural supervisor, thinks there has been a noticeable reluctance by athletes to totally commit themselves to a sport. This is due, he believes to "students seriously thinking about athletics and where it fits into their lives. High school athletes are not automatically becoming college athletes anymore. They're trying to become well-rounded and adept in things other than sports. Consequently, many are only willing to make a partial commitment anymore."

Varsity losses have been a windfall to intramural sports at M.I.T. The 19 sports currently organized on an informal, living group basis are designed to fill the recreational gap for students who enjoy athletics but don't have the time, dedication or talent demanded of varsity players. Participation here during the last decade doubled to about 5,800 by 1969-70. I.M., though, is the most severely hampered financially of any M.I.T. athletic activity. Greater staff support and paid student assistance are needed to provide for expanding programs, but M.I.T. budgetary difficulties have precluded such an increase. Indeed, the Athletic Department—and particularly the intramural program—has been forced to react to financial pressure by cutting down to a minimum budget. This has essentially eliminated both staff overtime and outside services. Despite such reductions "programs are operating at their previous levels, but we're perusing every line of the budget very carefully."

M.I.T. athletic facilities are basically obsolete, Professor Barry maintains. Varsity, intramural, and newly-created women's teams all vie for use of the same facilities along with community members who don't belong on any team. Consequently, M.I.T. athletic areas, especially the swimming pool, are operating at maximum capacity. The Athletic Department is concentrating on developing new facilities in conjunction with the Planning Office, but the only major new facility within the next year will be a series of covered tennis courts scheduled for completion in October, 1971.

If casual athletic activity continues to increase without the addition of new sports facilities, Athletic Director Ross Smith's philosophy of "letting everyone compete on their own level" may not be feasible much longer.—*Joseph L. Kashi, '72*

The Carr Tennis Center

The J. B. Carr Indoor Tennis Center, an air-supported, inflatable structure, will rise on the M.I.T. campus this summer and be ready for use before inclement weather closes the outdoor tennis season next fall.

Howard W. Johnson, President of the Institute, announced the plan at the Commencement Luncheon on June 4; it is the result of a gift from Mr. and Mrs. J. B. Carr ('16) of Wilkes-Barre, Pa., and Palm Beach, Fla., and Mr. and Mrs. David B. Carr of West Palm Beach, Fla. The gift will also make possible construction of four new outdoor tennis courts, two near Westgate and two at a site to be determined.

Mr. Carr has played tennis for 60 years and regards it "as a lifetime recreational activity contributing to good health, relaxation, and long life. I am deeply interested in seeing this fine sport flourish at M.I.T.," he said in a statement released by President Johnson.

The inflatable building will be erected at the rear of Baker House, covering four tennis courts existing at that location. White on the outside, the structure will be 212 ft. long, 120 ft. wide, and 40 ft. high. The amount of the Carrs' gift and cost of the building were not stated.

A Place To Stop and Sit

Dominating the Building Seven entrance to M.I.T. are two constantly changing structures of shiny steel struts and bright wood panels that began as an experiment in "pure growth structures."

A descendant of the Architecture Department's "April Lobby" last year, the new lobby structures *(p. 100)* consist of a series of raised, furnished platforms that reach from the north portion of the main floor to the second floor mezzanine area. A recent addition on the south side of the entrance is similar but incorporates a good deal more furniture and a coffee stand on the ground level.

After neglecting student athletics all year, Technology Review *in June asked Joseph L. Kashi, '72, to summarize the season; his report (left) assures us that varsity quality and performance have been maintained. But, he writes, "there has been a noticeable reluctance by athletes to totally commit themselves to a sport," a theory to which the pictures on this and the opposite page lend little if any support.* (Photos: Joseph L. Kashi, '72, Sheldon Lowenthal, '74, and Bradley Billetdeaux, '73)

*M.I.T.'s austere main entrance lobby has intrigued architects for decades. This spring it yielded to two "growth structures" designed, according to one student, "to make the lobby a place where you could stop and sit." In the center picture, President Jerome B. Wiesner and Vice President John M. Wynne are shown doing just that. (*Photos: Joseph Kashi, '72 and David A. Townzen, '72)

"The idea," said Karen Vogel, an originator of the program, "is to make the lobby a place where you could stop and sit: we wanted to make the lobby a less transient place." Miss Vogel, a first-year graduate student in architecture, William Bertsche, also a first year graduate student, and Brandt Anderson, '72, first conceived the lobby as an Independent Activities Period project that "would be a specific project other than just building something." During the fall term, they had taken a design course with Professors Maurice Smith and Richard Termaglio which studied possible uses of the Student Center Plaza and Building Seven. With the guidance of these men, they began exploring present uses of the lobby and what might be done.

Although originally planned as a temporary, free-form structure that could grow in any desired manner, support and plans for the lobby project burgeoned. "Eventually," said Miss Vogel, "it grew to such an extent that funding from the Architecture Department and the administration was needed. We had to change from the idea of pure growth to something more planned."

When diverse elements of the Institute became involved, planning the lobby and building support for it became almost like taking a commission. The problems were more specific, Miss Vogel said, "because you're dealing with specific clients and you have to modify your ideas." Involving many aspects of general architectural practice the students were just learning, construction of the lobby integrated everything from floor-loading problems to cutting red tape and consulting with top-echelons of the administration. Among the most enthusiastic supporters of the plan was Corporation Chairman James R. Killian, Jr., '26.

The lobby structures will be in Building Seven until next January when the program will be evaluated and future plans made. Though these platforms may be left intact, moved to other parts of the Institute, or taken down, the students are planning to begin other projects around M.I.T. to utilize their skills in a way that will benefit the community.—*Joseph Kashi, '72*

For Making the Institute "A Better Place to Be"

It was a cold spring in New England, but a custom was renewed on one of the rare warm days when the year's highest achievements were announced at the annual Awards Convocation in the Great Court on May 18.

Highlights of the traditional ceremony:

◇ Kenneth R. Weisshaar, '72, Intramural Chairman, announced the establishment of a new award to honor the late Harold J. Pettygrove ('64), who died in 1969. Its purpose is to recognize outstanding service to intramural athletics, and its first winner was Robert C. Dresser, '71.
◇ The James N. Murphy Award, to an employee "whose spirited contributions to the Institute family have won a place in the hearts of students," was given to Paul W. Murphy (no relation), the *major domo* of the Electrical Engineering Department's undergraduate laboratories in Building 10. "Literally hundreds of students and faculty remember him with great esteem and great affection," said President Howard W. Johnson in handing Mr. Murphy his prize.

◇ Mrs. Karl T. Compton, presenting the 1971 Compton Prizes "for outstanding contributions in promoting high standards of achievement and good citizenship within the M.I.T. community," renewed her tribute to the Boston Stein Club—sponsor of the prizes—"for having contributed in so distinguished a way to making M.I.T. a better place to be." The winners: Stephen E. Shields, '71, who "has contributed broadly to the pleasure of music" at M.I.T.; Howard J. Siegel, '71, for "continuous, dedicated care and attention to the Class of 1971 and its involvement in our community;" Marvin A. Sirbu, "a conscientious and thoughtful contributor to M.I.T. in a time of creative renewal;" the International Students' Council; and the Tech Dames, the organization of student wives.

The warm days of spring seemed to be fewer in 1971, but on one of them the Institute community took time out for the Awards Convocation to honor outstanding contributions of their fellow colleagues. "Relevance resides chiefly in the way we use any or all knowledge," said Mrs. Karl T. Compton in presenting the Compton Awards; but she might as well have been speaking to the entire hour's proceedings.

◇ William L. Stewart, Jr. ('23) Awards for outstanding extracurricular activity were given to the Intramural Council; Andrew J. Rubel, '74, who made unicycles a part of the 1970-71 campus scene; Margrethe H. Zink, '72, mainspring of the M.I.T. Dance Workshop; Albion R. Fletcher, Jr., '72, Treasurer of the Technology Community Association; Leslie W. Fung, President of the Chinese Students' Club; and Stephen C. Ehrmann, '71, principal author of *How to Get Around M.I.T.*

Commodity Transport Head

Ernst G. Frankel, M.E.'60, Professor of Marine Engineering, has been named head of the interdepartmental Commodity Transportation and Economic Development Laboratory; he succeeds Alfred H. Keil, who becomes Dean of the School of Engineering.

Professor Frankel was among the organizers of the Laboratory in 1970, and

When Constance Houghton of the Technology Community Association retired this spring, a 35-year career of serving M.I.T. students and staff was ended. Robert M. Churella, '71, President of T.C.A., posed with the guest of honor at a reception and dinner for associates and friends this spring.

One of 73 "charter" initiates into M.I.T.'s new chapter of Phi Beta Kappa receives congratulations from Sanborn C. Brown, Ph.D.'44, Associate Dean of the Graduate School who is Secretary-Historian of the chapter, while Vincent A. Fulmer, Vice President and Secretary of the Institute, reviews the documents of the next initiate. William F. Bottiglia, Head of the Department of Foreign Literatures and Linguistics, told the initiates as President of the M.I.T. chapter that, though the "charter" group was limited to graduates in the Schools of Science and Humanities, "we are sure we can prove that . . . all of M.I.T.'s departments definitely rise above the vocational and unimaginatively empirical level. We are, in sum," he said, "trying to contribute to a redefinition of liberal education which will update the letter while preserving the spirit."

he has since worked closely with it in systems analysis and research on the movement of raw materials and processed goods; current projects include forecasts of transportation developments, computer-based modelling of transportation systems, and a data center on world shipping.

Professor Frankel joined the M.I.T. faculty in 1960 after a career with the Zim Israel Naval Co.; he holds the gold medal of the British Institute of Marine Engineering.

Two Outstanding Teachers

Woodie C. Flowers, an instructor in the Department of Mechanical Engineering, and Lawrence E. Susskind, an instructor in the Department of Urban Studies and Planning have each received Harry Manley Goodwin ('90) Medals and cash awards of $500 for "conspicuously effective teaching." The awards were presented at Commencement Luncheon on June 5 by Irwin W. Sizer, Dean of M.I.T.'s Graduate School.

Mr. Flowers, who received an S.M. in 1968 and the Engineer's degree in 1971 from M.I.T., is now completing requirements for his doctorate. He has taught introductory design subjects and a seminar in biomedical engineering. In support of his nomination a colleague wrote: "Students like him instantly, are enthusiastic about both his competence and design knowledge and his range of interests, which extends from fine arts to physiology and psychology." He has "more than any other instructor . . . an uncanny ability to 'turn on' young men, particularly . . . in creative design."

Mr. Susskind, who received a Master of City Planning degree in 1970 from M.I.T., was cited for his energy and talent—"just about the most unusual phenomenon we have had in our Department in about 25 years." In 1970-71 he was the moving force in initiating the new undergraduate program in urban studies, of which he is now Assistant to the Director. "Making the program work effectively during the first year required an exceptionally successful teaching effort," said one professor; "Susskind made it appear as though there was hardly any extra burden."

T.C.A.'s Changing Scene

Constance Houghton, who has been the manager of the Technology Community Association for 35 years, retired from M.I.T. at the end of the spring term. She joined the Institute when T.C.A. was the Technology Christian Association, and her dedication to the welfare of students persevered through generations of student administrations as well as the change in her organization's name.

The Activities Development Board took the occasion of the annual Awards Convocation *(see above)* to give Miss Houghton a special certificate of appreciation. Her service "to thousands of M.I.T. students, faculty, and staff" began "at a time when most student and community services were concentrated in the office of T.C.A.," and since then it has been "continuous and devoted," said the Board.

Phi Beta Kappa Turns Finally to Science

Seventy-three members of the Class of 1971 are now also members of Phi Beta Kappa— the first M.I.T. seniors to be elected to the new Massachusetts-Xi Chapter, which in turn is the first chapter of the prestigious national liberal-arts honorary at any engineering school and the first authorized to elect undergraduates with S.B. (instead of B.A.) degrees.

Seniors graduating from M.I.T. in the social, physical, and life sciences and in the humanities are eligible for election to Phi Beta Kappa if they have taken two years of mathematics and two years of a foreign language at the Institute, or four years of these in high school, according to the national society's rules; engineering, architecture, and management students are not eligible. Accordingly, the "charter" group of members included 4 majors in biology, 9 in chemistry, 4 in earth and planetary science, 5 in economics, 1 in humanities, 24 in mathematics, 25 in physics, and 1 in political science.

Each student elected had a cumulative rating of at least 4.6 (5=A) throughout his undergraduate career.

Observers of the Institute scene need have no fear that the liberal arts have driven another nail into M.I.T.'s coffin. Charles P. Kindleberger, Professor of

Economics who delivered the Phi Beta Kappa oration following the first initiation ceremony, admitted that "the notion of Phi Beta Kappa at M.I.T. is mind-blowing." But he noted the preponderance of majors in the School of Science among the new initiates, and he concluded, he said, that "we are honoring the culmination of the Compton 'breakthrough,'" when science really found its place as part of "a technical school turning out 'cookbook' engineers."

"Trapped by the presence of a wristwatches and the absence of waistcoats," said Professor Kindleberger, today's Phi Beta Kappa keys may find themselves "in a box along with the dress shirt studs." But that need not demean "the life of the mind;" he urged the initiates to take pride in their achievements: the critical intellectual is likely to be the most revolutionary of men, he said, and curiosity about man and nature are the mark of real scholarship everywhere

In Phi Beta Kappa tradition, the ceremonies were concluded by a Phi Beta Kappa poet—in this case Barry B. Spacks, Associate Professor of Literature. Professor Spacks chose to read a selection of his own poems in which "ambition" might be seen as a common thread: some stanzas about a poet and a computer both writing verses into the late hours, the script outline for a low-budget film about balloons and ever-prettier girls, and a dialogue between Plato and Perkins. Finally there came "The Cells," the 1971 Phi Beta Kappa poem about how most sons follow their fathers, foibles—unless, somehow, their teachers succeed in their largest mission.

New Faculty Assignments

Five major new faculty assignments were announced at the Institute as the term ended this spring:

◇ Wilbur B. Davenport, Jr., Sc.D.'50, Professor of Electrical Engineering, to be Associate Head of the Department for Electrical Science and Engineering.

◇ Robert M. Fano, '41, Ford Professor of Engineering, to be Associate Head of the Department of Electrical Engineering for Computer Science and Engineering.

◇ Edward Fredkin, Professor of Electrical Engineering, to be Director of Project MAC, succeeding Joseph C. R. Licklider, Professor of Electrical Engineering, who will return to full-time teaching and research.

◇ John Ross, Ph.D.'51, retiring as Head of the Department of Chemistry, to be the first Frederick George Keyes Professor of Chemistry.

◇ Campbell L. Searle, S.M.'51, Professor of Electrical Engineering, to be Clarence Joseph LeBel Professor for a two-year term.

All appointments were effective July 1.

Professors Davenport and Fano will serve with Louis D. Smullin, '39, Head of the Department of Electrical Engineering, to coordinate academic programs and faculty development within the two broad subdivisions. The announcement stressed that there is no intention of dividing the Institute's largest department into two units and that all faculty appointments would continue to be made to the Department as a whole.

Project MAC, which Professor Fredkin will now direct, is a major center for research on time-shared, interactive computers and computer programming. Professor Fredkin first came to the Institute Campus as Visiting Professor in 1968, having earlier served at Lincoln Laboratory in artificial intelligence and pattern recognition research and at the Cambridge firm of Bolt, Beranek, and Newman, Inc.; he is the founder of Information International, Inc.

The Keyes Professorship honors a former Head of the Department of Chemistry who has been associated with the Institute for over 60 years; Professor Ross has himself been Head of the Department for five years and now relinquishes that post to devote full time to teaching and research.

The appointments of LeBel Professors are for two-year terms, that period to be devoted to teaching and research of a scope outside the incumbent's normal responsibilities. It was established by Clarence J. LeBel, '27, and Professor Searle's plans are to conduct work in signal processing, particularly as applied to music.

Alumni Fund: 1971 Is Breaking the Record

The 1971 Alumni Fund, already ahead of the 1970 Fund, is headed for a new record in number of donors—and a near-record in total giving, Howard L. Richardson, '31, Chairman of the Alumni Fund Board, told over 1,200 alumni guests at the Annual Alumni Homecoming Luncheon on June 7.

As of June 4, he said, total giving to the 1971 Fund was $2,323,945, compared with $2,132,920 one year ago at the same time. With only four weeks to go, the total will almost surely not reach the all-time record of some $2.8 million set by the 1968 Fund; but it will substantially better the $2.3 million of 1970 and could surpass the second-best year, 1968, when the total was $2.425 million.

The June 4 figures include the gifts of 18,291 donors, more by nearly 1,000 than had given on the comparable date last year. With this record on which to build, Mr. Richardson said, the 1971 Fund may very well set an all-time record in the number of individual gifts.

The 1971 success, said Mr. Richardson, is partly the result of a markedly increased "telethon" program. Over 200 alumni—more than twice as many as ever before—participated by placing over 12,000 calls, speaking with 4,400 alumni throughout the U.S. Nearly 3,500 pledges to the 1971 Fund were received during "telethons," said Mr. Richardson.

Paul V. Keyser, Jr., '29, President of the Alumni Association, was clearly impressed by Mr. Richardson's evidence that M.I.T. alumni "really cared," in the sense of President Howard W. Johnson's address to M.I.T. graduates on Commencement Day (*see above*). "M.I.T. has emerged from its testing by those who would weaken or destroy it even stronger than it was before," he declared.

Understanding Inflation

When too much money is chasing too few goods the result is inflation, explained Sidney S. Alexander, economist who is Professor of Management at M.I.T.'s Sloan School. "The best we can hope for in 1971 is a three- to four-per-cent rise," he said, addressing an early-spring gathering of the Boston Stein Club on the M.I.T. campus.

The only way we have to stop inflation is to engineer a recession. But inflation would have to be much greater than it now is to perform its "medicine" role in the economy, he said. This means more unemployment and financial hardship for some people—particularly the poor and those on fixed incomes like social security and pensions—and it also affects the value of bonds. Less aggregate demand for goods and services is what brings inflation down. and unemployment is a side effect of policy aimed at accomplishing this. The question then is, How much are we willing to pay?

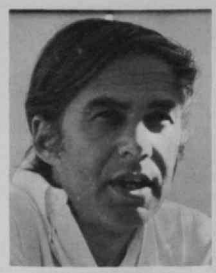
The general workings of inflation are well understood, but a more sophisticated idea of its workings is needed. Even with our present tightening of the economy, prices are still going up. As for understanding its behavioral laws, "Inflation hasn't had its Newton yet," said Dr. Alexander. For example:

◇ A one-per-cent increase in unemployment yields a three-per-cent loss in output.
◇ Unemployment is not the same as lack of employment. When unemployment increases by one per cent, employment drops two per cent.

When you are trying to keep wages and prices in line, productivity is "the hero of the piece," said Dr. Alexander. How can it be stimulated? Again, nobody knows exactly. In the past the economy has been stimulated by running close to productivity capacity. This in turn means bringing in new technology to increase productivity per person/machine. But productivity has to be sacrificed to reduce inflation. In years past, to reduce inflation one per cent we had to sacrifice $30 billion in productivity. This figure may now be as high as $60 billion, he said.

W. J. Hamburger, '21

W. F. Koppes, '29



M. E. Goody, M.A.R.

A. K. Ackoff, S.M.

G. Rosenfelder, S.M.

C. C. Park, '50

L. Minbiole, Jr., S.M.

N. J. Zabusky, S.M.

P. E. Weamer, '49

R. E. Dargie, '52

E. B. Walker, '44

J. F. Nicholson, '50

"Inflation wouldn't be so bad if there was 'honesty'—an automatic built-in escalator clause—in pensions, bonds and fixed incomes," he said. "For the economy as a whole inflation is costless," that is, inflation redistributes wealth but does not lessen it. The cost of this redistribution, however, is borne by those least able to bear it.

Individuals Noteworthy

To **William R. Jackson,** '30, the Silver Buffalo Award of the Boy Scouts of America . . . to **Woodie C. Flowers,** M.E. '71 and to **L. E. Susskind,** M.C.P.'70, both M.I.T. Instructors, the Goodwin Medal . . . to **Egon Orowan,** Senior Lecturer at M.I.T., the Vincent Bendix Gold Medal Award . . . to **Paul D. Goldstein,** '67, the Mosby Company Book Award . . . to **Robert L. Frank,** S.M.'39, the 1971 Pioneer Award of the I.E.E.E. Group on Aerospace and Electronic Systems . . . to **Donald S. Stookey,** Ph.D.'40, the Eugene C. Sullivan Award by the Corning Section of the American Chemical Society . . . to **Walter J. Hamburger,** '21 and **Wayne F. Koppes,** M.A.R.'29, the A.S.T.M. Award of Merit and named Fellows of the American Society for Testing and Materials . . . to **Robert C. Reid,** Sc.D.'54, the Distinguished Engineering Alumnus Award by Purdue University . . . to **Albert G. H. Dietz,** '32, the International Award in Plastics Science and Engineering of the Society of Plastics Engineers . . . to **Henry Schade,** S.M.'28, the Gibbs Brothers Medal from the National Academy of Sciences . . . to **George T. Rado,** '39, the Navy Award for Distinguished Achievement in Science to **Louis J. Minbiole, Jr.,** S.M.'41, The 1971 "Design in Steel" Award of the American Iron and Steel Institute . . . **Harry F. Raab, Jr.,** '50, to Fellow of the American Nuclear Society . . . **John R. Hutchins, 3rd,** Sc.D.'59, to Fellow of the American Ceramic Society . . . **Robert Goodman,** '60; **Thomas Huang,** Sc.D.'60; **J. David Litster,** Ph.D.'65; **James Melcher,** Ph.D.'52; **Nathan Sivin,** '52; **Norman J. Zabusky,** S.M.'53, to Guggenheim Fellows . . . **Harold E. Edgerton,** Sc.D.'31, Institute Professor Emeritus, honored by the New England Aquarium for assistance in the development of the Aquarium.

Elected to American Academy of Arts and Sciences: **William F. Brace,** '46; **Paul E. Gray,** '54; **Richard H. Holm,** Ph.D.'59; **Eugene B. Skolnikoff,** '49 . . . To **Willard F. Babcock,** '39, the Outstanding Teachers Award, North Carolina State University . . . to **Ralph Warburton,** '57, the Award for Design Excellence by the Department of Housing and Urban Development . . . to **Frank Press,** Head of M.I.T. Department of Earth and Planetary Sciences, the Gold Medal of the British Royal Astronomical Society.

Honorary doctorates to: **John G. Truxal,** '47, from the Indiana Institute of Technology; **Leo L. Beranek,** Instructor at M.I.T. Acoustics Lab and Lecturer, from Bolt Beranek and Newman Inc.; **Edgar D. Mitchell,** Sc.D.'64 and **Gyorgy Kepes,** painter and M.I.T. Professor of Visual Design, from Carnegie-Mellon Institute; **Robert R. Shrock,** former chairman of M.I.T.'s Department of Geology, from Indiana University.

To membership in National Academy of Sciences: **William F. Brace,** '46; **Marvin Chodorow,** Ph.D.'39; **Vladimir Haensel,** S.M.'37; **Hans W. Liepmann,** '57; **Irving M. London,** M.I.T. Professor of Biology; **Nevin S. Scrimshaw,** M.I.T. Professor of Nutrition and Head of Department of Nutrition and Food Sciences; **Philip Morrison,** M.I.T. Professor of Physics; **William D. Philips,** '28; **Frederic M. Richards,** '48; **John R. Schrieffer,** '53.

Marvin E. Goody, M.A.R.'51, to American Institute of Architects . . . **Frederic D. Riley,** '28, appointed Aide-de-camp on the Staff of the Governor of Virginia . . . **Richard S. Bodman,** S.M.'61, to Assistant Secretary of the Interior for Administration . . . **Stephen J. Lukasik,** Ph.D.'53, to Director, Advanced Research Projects Agency, Department of Defense . . . **Albert K. Ackoff,** S.M.'39, to Secretary, Continuing Engineering Studies Division, American Society for Engineering Education . . . **Donald G. Fink,** '33, appointed to President Nixon's Advisory Council on Management Improvement . . . **John Sheehan,** M.I.T. Professor of Chemistry, appointed to National Advisory Research Resources Council . . . **Ernest R. Gilmont,** Ph.D.'56, to President-elect, American Institute of Chemists . . . **Finley B. Laverty,** '25 and **George P. Palo,** '28, to members, American Society of Civil Engineers.

Albert O. Riordan, S.M.'62, to Manager of Industrial Engineering, Kodak Apparatus Division . . . **Paul E. Weamer,** '49, to President and Director, Republic Foods, Inc. and Rouse, Inc. . . . **Robert E. Dargie,** '52, to Manager, Systems Planning and Advanced Engineering, American Optical Corp. . . . **Charles C. Park,** '50, to Director of Sales, Gleason Works . . . **J. Povah Lynch, Jr.,** '52, to Assistant Director of Technology, Anaconda Co. . . . **Robert G. Foster,** S.M.'63, to Division Technical Director, Corning Glass Works . . . **Robert B. Semple,** '32, to Chairman of the Board, B.A.S.F. Wyandotte Corp. . . . **Wylie S. Robson,** S.M.'56, to General Manager, International Photographic Division, Eastman Kodak, Co. . . . **Gerald S. Rosenfelder,** S.M.'67, to Vice President, Project and Systems Management, Bell Aerospace Co. . . . **Edward B. Walker,** '44, to Vice President, Gulf Oil Corp. . . . **Jay R. Bonnar,** '57, to Manager, Powders and Arts Products Division of Handy and Harman . . . **J. Paul Leahy,** '59, to Assistant Controller, Norton Co. . . . **E. Kirkbridge Miller,** '41, to Chairman of the Board, Rowe Price Management Co. . . . **W. L. Wise, Jr.,** '34, to Second Vice President, American Supply and Machinery Manufacturer's Association, Inc. . . . **John F. Nicholson,** '50, to Vice President of Marketing, Sugarman Laboratories . . . **A. J. Kelly,** '43, to Vice President and

Talent Available

These announcements are published in *Technology Review* without cost for graduates of the Massachusetts Institute of Technology who have registered their interest in new professional opportunities with the Institute's Alumni Placement Office. Such alumni are invited to submit statements, not exceeding 50 words and including relevant details of field and date of degree, professional experience, and interests to the Editor, *Technology Review*, Room E19-430, M.I.T., Cambridge, Mass., 02139. Each announcement will be published in a single issue of the *Review;* subject to the availability of space, announcements received by August 25 will appear in the *Review* for September/October, 1971. The identity of advertisers will not be revealed either in print or in correspondence; respondents' letters, addressed to the appropriate key number at *Technology Review*, will be forwarded unopened to the advertiser.

Physical Metallurgist: Sc.D.'68. Varied experience in fatigue and fracture emphasizing structural reliability through a control of microstructure by alloy and process development. Publications include work in both ferrous and non-ferrous alloys. Seek applied research/development position. Location open. Key JUB1.

Manager, Quality Assurance: S.B.'58 in mechanical engineering with 13 years' experience in quality control, reliability. Currently responsible for reliability/maintainability for GE T64 engine. Present salary $18,000-location open. Key JUB2.

Marketing and Sales: S.B.'69 business management, S.B.'69 aeronautical engineering. Two years' experience in jet engine engineering; seeking position in marketing or sales. No regional preference, will accept overseas assignment. Salary open. Key JUB3.

Programmer: S.M.'58, E.E.'61, licensed professional engineer. Eight years' experience in programming and engineering, five years in New York metropolitan area. Fortran, Cobol, and assembly language. Univac, XDS, C.D.C., and I.B.M. machines. Mainly scientific, some commercial applications. German. Would prefer to stay in New York metropolitan area. Key JUB4.

Manager: S.B.'48 in aeronautical engineering. Experienced in engineering, administrative, research, development, new production planning, and executive manager. Wide product experience—including systems analyses—from aerospace equipment to structural plastics; developed first successful polyurethane foam core for pleasure boats. Location preference, in order: northern New Jersey, Northeast, West. Salary open. Key JUB5.

Product Development—Chemicals: S.B.'54 with 17-year proven record in technical/commercial development of specialty organic chemicals for polymer, paper, textile, water treatment, and chemical specialty fields. Major emphasis on increasing profitability of product line. Key JUB6.

Manager of Buildings and Facilities: S.B.'50 in mechanical engineering; registered professional engineer in four states. Twenty years' experience in mechanical construction and maintenance, primarily as owners' engineer. Has effected significant savings on multi-million-dollar projects, including skyscrapers, shopping centers, and industrial facilities. Major responsibility all mechanical aspects, including design and supervision. Experienced negotiator and administrator. Remuneration negotiable. Prefer Greater New York; can relocate. Key JUB7.

Information Systems Analysist: S.B.'62 electrical engineering, M.B.A. marketing and operations research, Wharton '64. Two years' experience in data processing sales, five years' in consulting. Experience in software package design, model building, warehousing, inventory control accounting systems and computer hardware selection. Salary and location open. Key JUB8.

Product Planning Engineer: S.B.'52 in mechanical engineering, graduate work at Argonne Laboratory (nuclear) and Northeastern (engineering management). Nineteen years' engineering and marketing experience on mechanical and electromechanical devices for industry and government. Creative; dozen patents; strength in economics. Prefer small non-defense-oriented company, Boston area, but will move if the challenge is there. Salary open. Key JUB9.

Ocean Engineering: S.B. Naval Academy; S.M., Nav. Eng., M.I.T. Leaving military service, seeking responsible position in engineering research or management of ocean systems. electrical engineering crosstraining, S.M.(electrical engineering) in e/m field theory, application. Field experience in auto-transfer systems, industrial management, evaluation of systems, technical writing. Salary open; mobile, married, no children, no strong geographic restrictions. Key JUB10.

Mechanical Engineer: Sc.D.'63; Broad design, administrative and new business experience in fluid flow and electro-mechanical instrumentation. Developed and patented a hard-copy, computer terminal with graphics capability for time-sharing market. Seeking venture capital or buyer and new entrepreneurial challenge. Prefer Pacific Northwest but will relocate. Key JUB11.

Manager, Equipment or Data-Handling Systems Engineering: S.B.'49, S.M.'51 in electrical engineering; 20 years' experience in instrumentation, data-handling equipment development, design and analysis of information systems, computer graphics. Currently responsible for design and development of data-handling hardware and software and systems design and analysis. Prefer Northeast. $27,000. Key JUB12.

Corporate Planning; Management Decision-Making; Functions; Operations Analysis: S.B.'66 in aeronautics, S.M.'67 in flight transportation. Presently in market research and analysis for the commercial aircraft industry. Experience in model development, transportation economics, strategy planning, forecast methodology, financial planning, aircraft performance, and economic evaluation. Special interest in airline operations or aviation consulting, but would willingly consider other fields. Desire relocation Eastern U.S. Key JUB13.

Biotechnical Management: S.B.'65 Northeastern, S.M.'68 M.I.T., both in biomedical fields. Experience: eight years clinical laboratory, five years biomedical (physiology-biochemistry) research with publication, three years *very* successful sales with major research chemical company. Presently, senior representative responsible for $750,000 territory dealing with government research institutions. Seeking sales management position with a congenial environment and future. Salary: above $17,000; prefer New England area. Key JUB14.

Chemical Engineering: S.B.'65. Wide experience in nuclear field; seeking employment as technical liaison or research engineer. Presently responsible for vulnerability studies with Draper Laboratory. Boston area preferred, but will relocate. Key JUB15.

Chemical Engineer: S.M.'33, broad experience with international petroleum and chemical operations involving investment coordination, marketing research, technical service, process engineering, and manufacturing including experience with environmental problems. Registered professional engineer New York. Available immediately for consulting or full time. Key JUB16.

General Management: proven 42-year-old operating executive. Profitably managed multi-plant and multi-company operations in consumer, plastics and metal-working fields. Established international plants. Increased profits of $9,000,000 company from $700,000 to $1,200,000. Currently Group Vice President of $75,000,000 N.Y.S.E. listed company. Key JUB17.

Mechanical Engineer: S.M.'68, majors in fluid mechanics and heat transfer. Twenty-eight-years-old, dynamic, diverse background and experience both domestic and foreign. Experience in R & D-pumps, compressors, combustion equipment, regulation. Publications; business courses; fluent French. Looking for challenging position on East or West Coast. Key JUB18.

General Management: S.B.'33, S.M.'34. Demonstrated ability to successfully generate growth through technological innovation. Previous experience includes Vice Presidency R & D and Presidency, several Directorships. Seeks active management role in medium-sized company or corporate staff position in large company. Available for consulting assignments or Directorships. Philadelphia area. Key JUB19.

Program Manager—Weapon System: S.B.'47, Sc.D.'50 in aeronautical engineering. Douglas Fellowship; 4 years M.I.T. contract research in aeroelasticity; 10 years U.S.A.F. weapon systems requirements analysis; 10 years profit-successful executive on company research; systems engineering for civil and social programs and contract aerospace projects. Extensive publications, professional activities and honors. Consultant, U.S.A.F. Salary minimum, $30,000. Location open. Key JUB20.

Market Research—Marketing Generalist: S.B.'60 in electrical engineering; Ph.D., Brandeis '67, psychology. Consumer and industrial research experience, qualitative and quantitative; knowledge of foreign languages; handy with computers and statistics; excellent writing skills and selling ability; able to manage creative people, contribute to corporate profits. Prefer New York/New Jersey Metropolitan Area. Salary $15,000 negotiable. Key JUB21.

Engineer—Industrial Designer: B.S.'59, in mechanical engineering; M.S.'62 in product design from the I.I.T. Institute of Design (Chicago Bauhaus). Seeks position with an enterprise committed to the development of products for the urban environment. Experience, including masters thesis in urban transportation systems—particularly, those related to central city "people mover" concepts. Broad management experience covering all aspects of product planning, technical development and market exploitation. Background in the diversification of defense industry interests into non-defense fields, transportation and resource monitoring. Location and salary open. Key JUB22.

Organizational Development: B.A.'65, in economics; S.M.'67 in management; graduate work in social psychology from 1967 to 1971. Experience: staff member O.D. and research project (design, implementation, and evaluation of O.D. activities and change agent training); teaching; group trainer; manager of a college radio station; electronics technician. Desires O.D. work with consulting firm or energetic in-house group. Salary and location open. Key JUB23.

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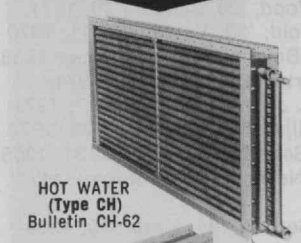

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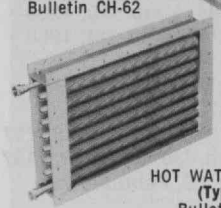

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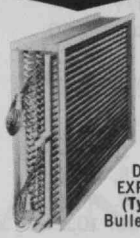

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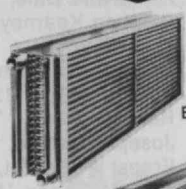

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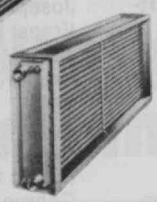

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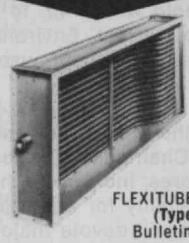

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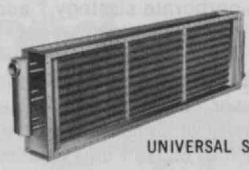

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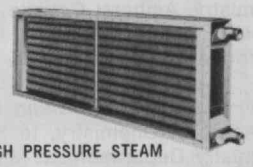

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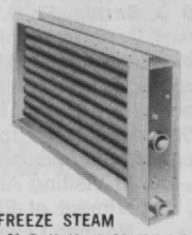

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Director, Butterworth Systems, Inc. **Maurice F. Granville,** S.M.'39, to Chairman of the Board, Texaco Inc. . . . **John C. Stetson,** '43, to Director of A.B. Dick Co. . . . **Elmer J. Roth,** '35, to Vice President—Finance, Loctite Corp. . . . **David E. Butler,** S.M.'61, to General Manager, Chicago offices, Bonner and Moore Associates, Inc. . . . **Frank T. Wheby,** '52, to Head of Underground Projects Division, Harza Engineering Co., Chicago . . . **Roger E. Travis,** '59, to Board of Directors, Smaller Business Association of New England, Inc. . . . **Solomon J. Buchsbaum,** Ph.D.'57, to Executive Director of Research, Communication Principles Division, Bell Laboratories . . . **Albert M. Clogston,** '38, to Vice President for Research, Sandia Corp. . . . **Paul V. Keyser, Jr.,** '29, to Board of Directors, Witco Chemical Corp. . . . **Morgan C. Sze,** '39, to Vice President, Lummus Co. . . . **Gilbert M. Roddy,** S.M.'31, to Chairman of the Board, Arkwright-Boston Insurance . . . **Arnold Arch,** '40, to Manager, Air Pollution Control, Environmental Quality Department, Westinghouse Electric Corp.

Howard W. Johnson, who became Chairman of the M.I.T. Corporation on July 1, to Vice Chairman of Federated Department Stores, Inc., where he will have "responsibility for Federated's central staff and will devote major attention to future corporate strategy," according to the official announcement.

Vytautus Klemas, '58, to Associate Professor, College of Marine Studies, University of Delaware . . . **Richard D. Fink,** Ph.D.'62, to Full Professor of Chemistry, Amherst College . . . **Albert H. Bowker,** '41, to Chancellor, University of California, Berkeley.

M.I.T. appointments: **Glenn A. Berchtold,** Professor of Chemistry, to Head of Chemistry Department at M.I.T. . . . **Donald S. Barton,** Ph.D.'68, to Assistant Professor, Department of Physics . . . **Stephen P. Loutrel,** S.M.'66, to Assistant Professor, Department of Mechanical Engineering . . . **Donald L. Kreider,** Ph.D.'59, to Visiting Professor in Department of Mathematics . . . **Thomas M. Cover,** '60, to Visiting Associate Professor, Department of Electrical Engineering . . . **Norman Levinson,** '33, to Institute Professor . . . **Amar G. Bose,** '51, to Professor, part-time, Electrical Engineering . . . **Ira Dyer,** '49, to Professor of Ocean Engineering . . . **Kang-Lung Wang,** Ph.D.'70, to Assistant Professor, Department of Electrical Engineering . . . **Theodore P. Labuza,** Ph.D. '65, to Associate Professor, Department of Nutrition and Food Science . . . **David R. Wones,** '54, to Associate Professor, Department of Earth and Planetary Sciences.

Deceased

Lyman F. Hewins, '98, May 9, 1971
John Boyle, '01, June 2, 1971
Edith A. Beckler, '02, July 10, 1971*
George E. Kershaw, '03, March 3, 1971
Amasa M. Holcombe, '04, May 16, 1971*
Daniel M. Luehrs, '06, January 25, 1971
Ernest M. Smith, '06, December 31, 1970
Robert J. Ross, '06, March 19, 1971
Allen Pope, '07, November 9, 1969
Herbert A. Cole, Jr., '08, April 4, 1971*
Elliot Q. Adams, '09, April 12, 1971
Howard H. Dale, '09, June 9, 1971
Stephen Kearney, 2nd, '09, February 10, 1971*
S. Ashley Guthrie, '10, February 13, 1971
Robert S. Cox, '12, May 27, 1971
Randall Cremer, '12, April 16, 1971*
Joseph Desloge, '12, March 11, 1971*
Ernest W. DeWitt, '12, January 28, 1971*
John M. Leddy, '12, May 29, 1969
Leonard L. Stanley, '14, November 10, 1970
Carlton W. Eddy, '15, June 4, 1971
Henry M. Hunter, '16, September 13, 1970
E. Eric Schabacker, '16, April 23, 1971*
George H. Petit, '16, June 10, 1971
Charles Walter, '16, April 26, 1971
Alden D. Nute, '17, June 2, 1971
Selden Senter, '17, February 11, 1971
Leo McNally, '18, October 22, 1962*
William F. Bennett, '19, May 20, 1971
George U. Park, '19, April 20, 1970
Karl F. Rodgers, '19, March 27, 1971*
James Moir, '20, March 1971*
Milford P. Graham, '21, January 24, 1971*
Herbert Kaplan, '21, December 30, 1970
Howard F. MacMillen, '21, May 3, 1971*
David R. Merrill, '21, April 4, 1971*
Harold F. Stose, '21, May 13, 1971*
Ralph W. Wood, '21, April 18, 1971*
Jerome L. Boyer, '22, December 25, 1965
Chester W. Greening, '22, May 29, 1971
William A. Hoops, '22, August 12, 1970
Aaron Radin, '22, April 13, 1971
Harry E. Rockefeller, '22, May 1971*
Henry M. Schley, '22, May 2, 1971
Francis E. Slayter, '22, April 26, 1971
Francis W. Spalding, '22, January 1, 1971*
William K. Taft, '22, March 9, 1971
Edwin H. Arnold, '23, January 14, 1971
James I. Rooney, '23, September 22, 1970
Charles H. Toll, '23, June 12, 1971
Galen H. Sayler, '24, March 9, 1971
Thomas M. Nevin, '24, May 17, 1971*
Raymond Marsh, '24, February 8, 1971
Ronald H. Shaw, '24, February 20, 1971
L. Stuart Lankton, '24, October 10, 1970
Myron E. Doucette, '25, May 2, 1971
David J. Hillis, '25, April 2, 1971*
Marriott C. Johnson, '25, July 14, 1969
William C. Baker, '26, December 1967
Matthew C. Blume, '26, March 25, 1970
Charles F. Kirsch, '26, June 18, 1970
Leon N. Laitzevsky, '26, May 20, 1971
Bernard P. Posser, '26, October 23, 1970
Frank M. Gorsuch, '27, March 22, 1971*
Reginald F. Jacobs, '27, May 5, 1971
Edward S. Thompson, '28, February 25, 1971
David B. Wood, '28, January 10, 1971
Guy L. Arnold, '30, September 11, 1970
William N. Boynton, '31, December 1958
Paul B. Hartman, '31, April 4, 1971
Leonard W. Johnston, '31, May 7, 1971
Oscar L. Lilja, '31, September 28, 1970
James M. Schaffer, '32, August 31, 1955
George A. Newman, '33, February 14, 1971
Ralph W. Berdan, '34, March 10, 1968
William I. Hathon, '34, August 14, 1968
Clarence Cohn, '36, May 1, 1971*
Arthur Sedoff, '36, February 10, 1971
Ray P. Rossman, '37, April 1971
Robert B. Mancib, '38, February 26, 1971
Wilbert C. Gumprich, '39, March 22, 1971
Abraham M. Potter, '39, February 15, 1971
Harlow J. Reed, '39, April 30, 1971*
John Fee, '40, March 1, 1971
Mrs. Philip E. Sheridan, '42, April 30, 1969
Johnathan Edwards, '44, January 1971
Charles V. Lynch, Jr., '44, October 9, 1970
Frank B. Wilder, '46, January 27, 1971
Fred Sylvander, '47, March 1971
Thomas A. Ratti, '49, March 21, 1968
David L. Bobroff, '51, March 8, 1969
James E. Smith, '55, May 15, 1970
Donald N. Graham, '61, May 10, 1971
Daniel S. Frischmuth, '64, March 15, 1971
John S. Shaberman, '66, April 2, 1971
Christopher G. Scott, '67, May 10, 1971

Class Review

96

William E. Barbour celebrated his 97th birthday on April Fools' Day. Springtime brought him and his daughter, Jane, back to Berryville, Va., after four months in Florida where they found the weather at Winter Park the best they had experienced in several years. Mr. Barbour reported to your secretary that he had enjoyed the putting green on the hotel grounds this year but made it clear that he had always enjoyed the activity of tennis to the slower sport of golf. This is one concession he has made to the passing of the years! In July, his second daughter will retire from her teaching position at Berry College in Georgia and come home to live.—**Clare Driscoll,** Acting Secretary, Cliff St., Plymouth, Mass.

02

I have to report the death of Miss **Edith A. Beckler** which occurred on July 10, 1970 in Cambridge where she had made her residence for many years. Her professional career is well described in *Who's Who in the East* and much of that given below is from that publication. "Instructor in bacteriology, Simmons College 1905-1945, Assistant Professor of Public Health, Emeritus; bacteriologist in charge, diagnostic laboratory, Division of Communicable Diseases, Mass. Department of Public Health, Boston, 1914-1946; member of Society of American Bacteriologists and Mass. Public Health Association; author of occasional articles on bacteriological subjects in medical journals."

In April 1958 Miss Beckler was presented the Lemuel Shattuck Award. This award is presented annually by the Mass. Public Health Association to a person who has made in the past an outstanding contribution to public health in the New England area. In the citation given with the award it is stated that Miss Beckler was the first full-time bacteriologist at the State Bacteriological Laboratory. She was also the first laboratory worker to receive the award. A notable career.—**Burton G. Philbrick,** Secretary, Greycroft Inn, 68 Dane St., Beverly, Mass. 01915

03

Well classmates, the big news is the crossing of the 90th barrier, on April 3 for your active Secretary. Since our discontinuance of our Happy Birthday column, our members lack this source for prominence in Class Notes. Your Secretary will wait for congratulations as a reward for arduous endeavour to keep our Class News column open.

I hope, unlike all recent commencements, the Secretaries of the earlier classes will be surprised by running into an occasional classmate.—**John J. A. Nolan,** Secretary-Treasurer, 13 Linden Ave., Somerville, Mass. 02143

04

Our sympathy is extended to the family of **Amasa Maynard Holcombe** who passed away on May 16, 1971 at his home on Snell Isle, Fla. After practicing law in Washington, D.C., for more than 40 years, he retired in 1958 and moved to Florida several years ago.

A native of Winchester, Mass., he received a mechanical engineering degree from M.I.T. and a law degree from George Washington University. During World War I he served as a major in the army and was on the staff of the assistant secretary of war. In World War II, he headed the patent division of the Office of Alien Property Custodian.

Mr. Holcombe was a member of numerous legal, engineering and patriotic organizations. A member of the Sons of the American Revolution and the Society of Mayflower Descendants, he had also been a longtime member of the University Club in Washington and an active member of the Rotary Club of Washington. He is survived by his wife Martha; a son, Marshall M.; a daughter, Mrs. Pierson McG. Hall; a brother, Arthur M.; five grandchildren and six great-grandchildren.

We are grateful to Alvin Guttag, Secretary of the Class of 1940 for this information. —**Eugene H. Russell, Jr.,** Secretary, 82 Stevens Rd., Needham, Mass. 02192

05

Since there is little news from classmates, this will have to be a report of your secretary's travels. Ruth and I have been making a daughter-visiting tour, with stops in Greensboro, N.C., Newark, Del., Mountainside, N.J., Boston and North Reading, Mass. While in New Jersey we drove up to North Caldwell to see **Harry Charlesworth.** He had been quite ill during the winter but had improved considerably and was up and around and "feeling great." He was quite unhappy about his inability to attend our 66th reunion, but felt confident that he would be able to be with us in June 1972. He has missed very few. I yearned to digress to chat with Fred Poole, Bill Spalding and George Whiting, but when you are guests, you tend to conform. Perhaps next time.

A letter from **Izzy Nye**'s daughter tells us that he has had a heart problem, which will prevent him from being with us on Alumni Day. Hope you'll make it in 1972, Izzy. . . . A letter from **Gilbert Tower** tells us he is still working steadily as town engineer, cooperating with the Cohasset, Massachusetts Planning Board. A copy of his five-page (#373) report indicates that he is active.

A change of address for **Gil Joslin**—P.O. Box 5577 Orlando, Fla. No explanation, but evidently Gil has become a permanent resident of Florida. News of our 66th reunion in the next issue.—**Fred W. Goldthwait,** Secretary, Box 32, Center Sandwich, N.H. 03227

06

Homecoming Day on June 7 was our sixty-fifth year out and I had written to several classmates urging their attendance, with their wives, at the luncheon that day. **Bob Rose** had telephoned that he and Anne would join Marion and me and Bertha Chase who was to be our guest. Our class president, **Stew Coey,** had planned to be with us too. **Bill Abbott** and **Walter Davol** were regulars through the years and perhaps they appeared also, maybe some others. You will have to wait for the next number

of the *Review* to get the full, true, story. Meanwhile send me a newsy letter about yourself and your family; how you are and what you do to keep out of mischief. Marion and I keep in circulation and Marion does all the driving now. I try to get in a walk every day and do a little work in and out.

We have one death to record. **Stephen Kearney, 2nd,** died on February 10, 1971, as reported to the Alumni Office by his wife, probably in Tyngsboro, Mass., where they had been living, I believe, while he was city engineer for the City of Lowell. Except for an interval in 1918, when Steve was a captain in the Engineer Officers Reserve Corps at Camp Lee in Petersburg, Va., his entire active life was as city engineer, retiring early in the sixties. The report of his death did not reach me until recently and a note of sympathy has now been sent to Mr. Kearney and family.—**Edward B. Rowe,** Secretary-Treasurer, 11 Cushing Rd., Wellesley Hills, Mass.

07

Along with thanks to Jim Barker, **Frank S. MacGregor** sent in the following contribution: "After thirty-two years with the du Pont Company, at the start of 1948, on my sixty-third birthday, I gave up my bachelor life and married one of the members of the Class of 1910, Mount Holyoke College. I had been invited to the 1910 Commencement by my sister and had met several of her classmates and have since kept in touch with them. After sampling winters in Florida and California and western North Carolina we decided in 1952 to build a residence (for winter use but still keeping my house in Wilmington, Del.) near Tryon, a small town on the North Carolina-South Carolina state line, in the foot-hills of the Blue Ridge Mountains. While our health was good we decided we could make Tryon our year-round home in 1968 and have found country life very enjoyable as the years have begun to hurry past."

Some bad health has slowed down the activities of **Edward G. Lee,** but this has not eliminated his interest in sending in some news for the class notes. He writes that in July of 1969 he suffered a bad attack of shingles on the upper portions of his face and head. He has spent a considerable amount of time in the local hospital in Homestead, Fla., undergoing treatment and medication. He continues: "By the end of the second month I could get up and walk around some, so one of my daughters took me to her home till I could find a place to be taken care of. Finally early in December 1969, when I had sold my home, I went to the home of my granddaughter, Mrs. Jane C. Bush, at 964—74th St. Ocean, Marathon, Fla. 33050, where she arranged to care for me. I am still there with her and manage to eat three meals a day, take a little exercise, then spend most of my time resting." Classmates might like to drop a line to Edward at the above address.

We have a short note accompanying the Alumni Fund contribution envelope sent by **Geroge A. Griffin:** "I miss the news of the Class of '07 since we lost our faithful reporter Phil Walker. I hope some of '07 men will offer to take over the job even if only occasionally. I am still in Woods Hole and keep pretty well." Now that '07 news is back in the picture again we hope George will send in more news.

From another active classmate, **Philip P. Greenwood,** we have received the following news: "In response to the letter from James Barker to the members of the Class of 1907—I do greatly miss seeing any 1907 news in recent issues of the *Technology Review* and volunteer the following: Five years ago we sold our home of 44 years and moved to an apartment at Springvale Terrace, Silver Spring, Md., a church-sponsored retirement home. In October 1969 my wife Elvira had a major operation and a few hours later had a stroke paralyzing her left side from which she has not yet recovered. This necessitated giving up our apartment and going to live with our daughter and husband Mr. and Mrs. George C. Rickard who also lived in Silver Spring.

"While far from 100 per cent healthwise, I can't complain considering my 86 years. I try to get in a walk of a mile or two each day, weather permitting, and I do from 12 to 15 push-ups nearly every morning. I help out some around the house and yard and last winter did some snow shovelling when we had an 11-inch snowfall. I am still driving my car locally and into Washington (10 miles) about twice a month. However, I rarely drive more than 10 or 15 miles from home and try to avoid any night driving. On the quarterly visits to my doctor he tells me I am doing fine and keeps prescribing the same medication. My long-range vision with glasses (which I have worn for over 60 years) is good. My bifocal vision is not good and while I do quite a lot of reading it is quite slow and when vision gets blurry I resort to a magnifying glass. The ophthalmologist calls it dystrophy of the cornea and says there is a beginning of cataracts but these are being held in check by eye-drops. I don't view television very much but listen to radio an hour or more a day. Being originally from Maine, I have a lot of ancestral roots in New England going back 300 years or more and have spent considerable time on genealogy and ancestral charts which I enjoy. I made a hurried trip to Florida last month to visit my 88-year-old sister whose health is very bad. We make occasional visits to our son and family in Pennsylvania which is 130 miles away and they visit us frequently."

The '07 mailbag is empty. Please don't let your classmates down; send your news to—Kathy Sayre, Class Notes Editor, M.I.T., E19-430, Cambridge, Mass.

08

Without other news, it is with sadness that we report the passing of **Herbert A. Cole, Jr.,** a graduate in mechanical engineering. Mr. Cole had made his home at 61 Elm St., Hingham, Mass. He died on April 3, 1971, following an illness of only three months.—**Joseph W. Wattles,** Secretary, 26 Bullard Rd., Weston, Mass. 02193

11

At the time some of us were enjoying our sixtieth reunion, two of our classmates with the help of their children

were celebrating their golden weddings. On June 4 it was Margaret and **Robert Morse** at their fine old home in Sandwich, Mass. I was happy to be able to drive down for the afternoon reception. Dorothy and **Oliver Powell** celebrated their anniversary on the other side of the continent in Glendale, Calif.

Professor **G. Arthur Brown** sent me a photograph of the members of Course X taken at about the time of graduation. In his accompanying letter he said he wished he could attend the reunion but it was impossible. However he noted that he went to Haverhill High School with Erving Young and Oliver Powell. . . . In reply to a personal letter I sent to Professor **Gordon Wilkes** regarding the reunion, he said he was sorry to let me down but the drive up and parking at M.I.T. are almost hopeless for him. . . . **Curtis Kinney,** who is trying to get his book *I Flew a Camel* published, said that though he goes to business nearly every day he does not feel able to make the trip to the reunion.

President **Howard Williams** and Katharine spent most of May on an automobile trip through the Dordogne section of France but were back for the reunion. . . . **Harold Robinson** said he wanted to attend the reunion but because of his near blindness it was not advisable. For ten years after his retirement in 1956 he spent his summers in Wilton, N.H. and his winters in Florida. Now he spends his time walking, and listening to talking book records and the radio.

Due to the time factor **Jim Duffy's** account of the reunion will not appear until the September-October issue of the Class Notes.—**Oberlin S. Clark,** Secretary, 50 Leonard Rd., North Weymouth, Mass. 02191

12

DO YOU REMEMBER the days when college students looked like human beings instead of long-haired, unbathed tramps? This was in the dark ages when a class would assemble wearing reasonably decent clothes including a shirt with collar and necktie. I recall a freshman class in forging, under the direction of our good friend, "Pop" Lambirth, which was assembled for a lecture and demonstration. One of our group, George Rhodes, came in late and was meticulously dressed. His long overcoat was fully buttoned and his derby hat was placed at just the right angle. This was too much for "Pop", who looked him over carefully and asked, "Where do you preach today, Sir?" Contributed by **Harold Mabbott.**

We are starting our column this month with the sad news of the passing of three classmates—**Ernest DeWitt,** Course II, of Osterville, Mass., on January 28; **Joseph Desloge,** Course VI, of St. Louis on March 11; and **Randall Cremer,** Course I, of New York City on April 16. All of these men died quite suddenly, and less than a year ago had reported they were in good health. Heart attacks were usually responsible. In the case of Joe Desloge, he died while making a business phone call to St. Louis from his retirement home in La Jolla, Calif. In all cases, we have written, expressing the sympathy of our Class.

The following interesting information regarding Joe Desloge was obtained from the *St. Louis Post-Despatch.* He was a "civic leader, industrialist, and philanthropist," and was descended from one of Missouri's pioneer families. At the time of his death he was board chairman of the Killark Electric Manufacturing Co. and Minerva Oil Co., and president of the Louisiana Manufacturing Co. and Atlas Manufacturing Co., all of which four firms he founded. As a conservationist, he donated 2,400 acres of land for a state Shut-In Park and gave the land for another park to the city. He was responsible for the restoration of two very old St. Louis churches. He had served as a president of the Academy of Science and as member of the board of the Missouri Historical Society and of the Jefferson National Expansion Memorial Association. His home, Vouziers, located on the Missouri River, was the scene of many charitable benefits. He is survived by his wife, four children, and 12 grandchildren.

John Pettingell says, "What a fine spring after an unusually tough winter. Hope to see you at Homecoming Day In June, and at next year's reunion!" . . . **Charlie Webber** is one of our 14 classmates who are still working. He is an engineer with the Lumberman's Mutual Casualty Co. in Boston, "a company that employs some retired men. This requires traveling in northern Massachusetts, New Hampshire and northern Maine which means much driving, but I enjoy it."

Jim Cook is getting along well. His granddaughter, Elizabeth Wilson, was inducted last March into Gamma Chi Sigma, the honor society at Becker Junior College, Worcester, Mass., from which she graduates this spring. . . . And from **Bob Cox,** "There really is no news. As I told you, we drove East last summer to attend my wife's 50th reunion at Wellesley. She is the collegiate member of the family. We spent three weeks in Phoenix, Tucson and Ojai last winter. And that is it!" Two long auto trips in eight months! Few of us could do that, Bob.

John Hall sends a report about retirement. "I have lost touch with many former friends, several of whom have died. It is nice, quiet and uneventful here and I have never been dependent on close associates. My wife and I are congenial and comfortable." He says, however, that he still keeps in touch with the health officials and their problems in promoting fluoridation of water supplies and has written a "thesis" on the subject from the health and cost saving standpoints, which he hopes may eventually be published.

Henry Foley has come out of retirement to reply to our repeated requests for news. You may recall he became an engineering consultant to the large Flint City Municipal Center project after his retirement from General Motors at 65. The project took ten years to build and he retired again in 1964. Since then he and his wife have enjoyed good health, and they have made another trip to Europe, as well as several trips about the United States, visiting friends and especially his four sons. He is one of the 325 members of the Birmingham Senior Men's Club and enjoys their activities, which include bowling, golf and bridge programs, as well as bus trips to Detroit

for ball games and theatre parties. Six years ago the Foleys celebrated their golden wedding anniversary, and both feel that they are lucky to be active for so long. "I hope that many of my classmates can feel the same way in 1971."

And **Bates Torrey** writes, "I have no news regarding my activities. Alice is still hospitalized, as has been the case for over two years. I have not been too well since my heart attack two years ago, but manage to get along by taking things easy at home alone. I do have a housekeeper in several days a week to make sure I am properly fed. Maybe I am getting old." Our very best wishes to you, Bates! . . . **Ken Robinson,** now 85, has recently decided to move to California where he and his wife will live near his son. He sends best wishes to the surviving members of the Class."

Paul Lawrence had been living in his home at Gary, Ind. since the passing of his wife in August, 1969. Early this spring, he sold the house and went to visit with his son, George, M.I.T. '47, in Sewickley, Pa. He planned to go back to Gary and then to Iowa, temporarily, on necessary business matters, and may later return to Sewickley. He says he is in reasonably good health. Our best wishes to you, Paul. . . . **Lee Bailey,** Course IV, writes briefly from Ft. Lauderdale, Fla., where he is retired, "I am in perfect health and enjoy living in this ideal city." . . . **Joe Champagne,** our dancing maestro, says he is well, but that he is no longer dancing as much as he used to. Guess Father Time treats us all alike. He is looking forward to our reunion next year. . . . **Jonathan Noyes** sends the sad news of the passing of his life partner, Caroline, on April 28, after an illness of well over a year, during which she was in a nursing home. Caroline was a most active and unusual person, and regularly attended our reunions with Jonathan. She had many friends among whom I counted myself. In behalf of the Class of 1912 we extend to you, Jonathan, our deepest sympathy. . . . A brief note from **Joe Boyer,** our loyal alumnus, reports from Gloucester, Mass. that he is in reasonably good health, but that he is no longer able to get about without a cane; even then 50 yards is about his limit.

A note was received from **Bob Wiseman** who recently lost his sister, who had been living with him in Arlington, Mass. for nearly two years. Bob has no other relatives, so he plans to sell the house and find an apartment. We all join in sending our sympathy, Bob. . . . **Harold Brackett** left Florida in mid-April and two weeks later arrived at his summer home in Limerick, Maine. He found some snow and had two weeks of cold and rainy weather, but reported signs of spring at last. . . . **Arch Eicher** weathered his Florida trip most satisfactorily. His wife, Agnes, writes that they are now hoping to attend the reunion next year. . . . **Harold Manning** writes from Woodbury, Conn., "We are looking forward to attending our sixtieth reunion, and may also see you at Homecoming in June. Both of us are quite well. I am still in charge of the programs for the Waterbury University Club which I have been doing since 1959."

I have also heard from **Julius Rosenberg** who was with us for but one year. He transferred to Sheffield-Yale from which he graduated in 1911. "We are doing fine and dandy here in Miami, and enjoying life to the fullest like a pair of old 'duffies'. In Detroit we had a really live M.I.T. Club. I wish the Miami Club was more active. Did you know that Vannevar Bush was a classmate of mine at Chelsea High School, 1908, and I was one of five from that class to enter Tech, though I stayed but one year. I wish you all well and hope to join you in 1972." . . . **Harold Mitchell** writes that he is nearly recovered from his siege of hepatitis which has kept him out of circulation much of the time during the last six months. Health permitting, he and Mildred will be with us at our reunion.

Our good friend, **John Hargrave,** reports that he is happy to advise that he can still walk, although at reduced speed. We are glad to know you are holding your own, John; arthritis is a mean disease as many of us know. . . . **John Barry** and his wife are in good health and he writes to say they took a trip to Bermuda this spring. They did not, however, find the weather much warmer than at home in Cohassett. . . . **Charlie Willis** is another of our classmates who is still active in his profession as an architect. He writes, "I recently read that Governor Sargent was proposing low income housing in Massachusetts; needed by thousands. I sent him drawings and text on my housing, having specialized in this field for fifty years with a good deal of publicity."

George Uman is a classmate who took a special Course I with us for two years. He is living at 1716 Carmona Ave., Los Angeles, and has been working on some special educational material as a hobby. He feels that this should be of interest to a producer of TV panel shows but, possibly due to his age, has been unsuccessful in getting an interview with any executive in this "tight" industry. I am passing this along in the hope that someone may be able to help him "to open the door."

At long last, **(Carl) Charles Rowley** has retired at 81 "to a career as a consultant." As an architect and engineer, he has been responsible for the design of a long list of the more important public buildings in and about Cleveland since 1932, and has also done some work on Cape Cod where he has summered for many years. In fact, he left Cleveland this year in mid-May for Harwichport, where he will remain until the end of June, turning his home over to his children and grandchildren as usual for the summer. . . . **Howard Cather** writes that he and his wife, Leiz, keep well, but there is little news. As reported in the May issue, they were forced to cancel their usual trip to Florida last winter. . . . **Jerry Hunsaker** says he is well and goes down to his office at Tech every day. "Hope we meet at the Reunion." . . . **Jack Connolly** writes, "Am still well and reasonably active."

We have a sad note from Helen Follett, wife of **Dave Follett,** saying that, "Dave is not enjoying good health and though he is up and around the house, I doubt that he will ever be able to attend another reunion. Both of us thoroughly enjoyed our 50th at Snow Inn."

Thank you for your generous response to my request for more news, which has made it possible to publish a full issue. In the letters received there are already indications that 25 persons

O. C. Clisham, '14, at work at an art show.

plan to attend our 60th reunion next year. We want at least forty, and it looks as though we will do even better.—**Ray E. Wilson,** Secretary, 304 Park Ave., Swarthmore, Pa. 19081

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Herman Affel has unfortunately been ill, and so hasn't been able in recent months to do his usual very competent job on our class news. Dorothy Affel has accordingly sent some accumulated information to your assistant secretary (and class beggar), and **Leicester Hamilton** has kindly volunteered to get the necessary typing done. We all hope that with the arrival of summer in the north country, Herman will be able to resume the writing and editing which have long made the news of our Class so interesting.

An announcement of an exhibition of paintings by **O. C. Clisham** at the "Old Forge" in Rindge, N.H., mentions that he took up art as a sideline in 1932, and after studying pencil drawing, started working in oils—chiefly landscapes—in 1942. He came to prefer oil as a medium because, "You can correct mistakes with it." His philosophy as to non-representational art is, "Why paint abstracts when man can never surpass the beauty of nature?" Clisham feels that New England is the most appealing area to work in; his favorite territory is in Vermont, on the north side of Mt. Mansfield. He has exhibited in several other places in New Hampshire, has won many honorable-mention ribbons, and is a member of the Nashua Artists Association. He means to keep on working and growing, hoping always to learn and to improve.

A letter which **Frank Atwood** wrote Herman from Martha's Vineyard in April reads, in part: "It was good to see in the *Review* that you had regained your eyesight completely. The main problem with growing old as I see it is that time goes so much faster. For example, the *Review* seems to arrive every week instead of monthly. And the past year seems to have been one Kennedy episode after another. We were sold out to reporters from all over the world during the January inquest and again during the short Grand Jury session—which amounted to nothing since they could not get the inquest data and had no money to call witnesses. Howard Neilson of WNAC-TV tried to close the book with a half-hour show on the ABC stations and on a pleasant note. He summarized the matter and showed how we Islanders could now get back to work and prepare for our summer guests. On it he showed the entrance to our estate, the gate to our Inn, the driveway and then the Inn itself. He caught me at the desk for an interview. I did not see it when it was shown, but a number of people around this area said it was very good."

Lois and I went to Mexico City in March for the three-day fiesta which the M.I.T. Club there puts on each year. It was a fine party, we met lots of nice people, and we were taken to a number of interesting places, including three very attractive private homes. After the fiesta ended, we spent a week sightseeing, with short trips to Cuernavaca, Taxco and Oaxaca. The weather was beautiful, and even included a minor earthquake. We recommend Mexico highly. In Cuernavaca I'd hoped at least to talk with **Ben Rauber,** who is among the eight thousand Americans who live there, but found that he was out of town.

Linwood D. Faunce died in Bloomfield, Conn., on February 8, 1971, at the age of 79, after an illness of several months. Born in Auburn, Maine, he lived in Cranford, N.J., for more than 30 years before moving to Bloomfield 15 years ago. He was with the Bell Telephone Company of New Jersey for 36 years before his retirement. He was a deacon of the First Congregational Church in Bloomfield, a member of the Bloomfield Historical Society, and past treasurer of the Hartford Association of Congregational-Christian Churches, and belonged also to the Pioneers Club of New Jersey. He left his wife, Florence Whittaker Faunce; a son, John D. Faunce, of Simsbury, Conn.; a daughter, Mrs. Nancy F. Webber, also of Simsbury; two sisters, seven grandchildren, and a great-grandchild, to all of whom the Class extends its sympathy.

New addresses: Hibbard S. Busby, P.O. Box 68, LaGrange, Texas 78945; Charles L. Cowles, 331 North Main Street, New City, N.Y. 10956; Freeland H. Leslie, 133 North Pompano Beach Boulevard, Pompano Beach, Fla. 33062. —**Charles H. Chatfield,** Assistant Secretary, 177 Steele Rd., West Hartford, Conn. 06119

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At this writing it's the opening of the baseball season with the annual scramble of the clubs to win—a welcome relief from the horrible daily front-page news of disorder, violence and crime. It was a tough winter here but in spite of the curves and sliders and change-ups that the weather has thrown at us, spring is at bat and ready to knock in a few winning runs. Late one night from Logan Airport, East Boston, Alice Anderson phoned that she was on her way to Portugal and would write later. I hope so. Good to hear from her. . . . Funny **Dick Bailey,** of Philadelphia writes: "Can you think of a better day of the year to write you a letter than April Fool's Day? I refer to me, not to you! Anyway I have at last paid my class dues. The thing that has displeased me most this year is that there is no 1915 Class Meeting in 'Fun City.' Of course, the end of these annual meetings has to come sometime, whether we like it or not. The only trip away from the Philadelphia area that I make in a year is that class meeting in New York. I will miss seeing you, Pirate Rooney, Ben Neal, and others. But I do plan to go over there some time this month to have a visit with **Charles** (Speed) **Williams.** I used to do that a day or so before or after the 1915 meeting. Question: Why should a boy named Williams go to Amherst? I am an alumnus of the Class of 1910, Williams College. There is no proper answer to that. I look forward to seeing you and the others sometime. Meanwhile keep good care of yourself and give my best regards to those M.I.T. men I know." We'll miss seeing him and that staunch and friendly old New York crowd.

Maurice Brandt: "You sure did escape a nice snow in Cambridge by being in

the Caribbean! I hope you and Fran had a lovely warm vacation. Herewith is check for class dues—you certainly run a very economical classy secretariat! I'm looking forward to future class notes about the enjoyable winter cruise I know you had." . . . **Lucius Bigelow,** Duke University, Durham, N.C., writes a very touching sentiment that warmed me all over. Many thanks Lucius and stick by your ship. "You, Azel, together with a few more of our most devoted members, have rendered an invaluable service to 'The Class Supreme', and have inspired all the rest of us to do everything which we were in position to do. It is also my belief that you are sufficiently stubborn that you will leave no stone unturned to see to it that M.I.T. 1915 shall be regarded as a leader for many a long decade into the future as the history of the Institute unfolds. As for me, I am still doing some consulting work in organic chemistry at Duke and practising a few constructive hobbies at home, while my wife is still both well and active. Perhaps it would be reasonable for me to add that my apparent lack of interest in travel is due to my presently highly restricted vision so that sightseeing to me has become largely a matter of the imagination. You may be sure that I, also, am stubborn enough that I shall never abandon my ship until after she shall have already sunk. Good wishes, good health, long life and good luck. We have seven grandchildren."

Helen and **Ken Boynton** divided the winter in Florida between Captive Island and Marco Island. Nice going Ken. . . . **Art Bond** wrote to Ben from Casselberry, Fla., "The Institute is fortunate to have such loyal supporters as you and Azel in these difficult times. After many years of fighting the New York State snows I feel pretty good here in Florida. I enjoy playing golf nearly every day and find congenial friends at the University Club in Winter Park, with a group of duplicate bridge addicts to show me how bad my game is. I see **Jack Dalton** there occasionally and have met C. W. Cleworth, the publisher, who remembers you as a Plastics Pioneer. This is a pleasant area of Florida and, if you should be coming this way, worth a visit. Also, after next fall, you can bring your grandchildren to Disneyland! The arrival of my first great-grandchild in February has made me realize that, at 80, I am now really in the 'senior' class."

We're looking forward to the pleasure of seeing **Alton Cook** here at the June 7 Class Party. . . . **Henry Daley:** "It was nice to receive your recent card from Panama, and I know Fran and yourself must have thoroughly enjoyed what appears to be your annual cruise in southern waters. Our family consists of the same three sons, their wives, and six grandchildren. Our oldest granddaughter who graduated from Dickinson College last June was married on February 5 which doesn't make us feel any younger. We hope to make the class cocktail party and dinner in June."

Harvey Daniels spent the winter at the good looking Casa Mia at Delray Beach. Ah, me! . . . **Dinger Doane** has moved to Reading, Mass. from Florida and will join the crowd at our Boston class parties. Glad to see him back here.

Bill Harbaugh has recovered from a recent cataract operation. All, the best, Bill, for a complete and successful comeback. . . . What an extensive and colorful trip Helen and **Otto Hilbert** must have had: "Just returned from two-month trip to Southern California and Florida. Went to San Diego from New York City by train with through sleeper from New York to Los Angeles, a most delightful trip. Arrived in L.A. day after earthquake but it did not affect our plans. While in Escondido, Calif., joined some friends for week trip by boat to Scammons Lagoon in Mexico where gray whales come each year to breed. We were able to get within 10-20 feet of them as they surfaced for air. Also stopped at some islands where seals breed. It was very interesting to get real close and watch the males fight to protect their group of females. We also stopped at some uninhabited islands with extensive beaches and sand dunes. A most enjoyable experience. Had only one day of rain entire time and sure missed some real winter in Corning."

Lee and **John Homan** enjoy their retirement at Indian Rocks Beach, Fla. and see a lot of Tess Hilton at nearby Clearwater—only a Martini away. "We had a good time last June at the 55th and expect to be present at 60th. Things are slow with us as we only play a little at golf and do the necessary buying. Trips are too much trouble and not worth much as I soon forget what I saw on the trip. Keep well." . . . In a letter to Ben, **Gil Peakes** describes an unusual and unpleasant experience: "It was good to have your note of February 19, with a few bits of information about the classmates. I, too, noticed the lapse of diplomacy on Azel's part, and I second the motion which you probably put in your note to him about asking for dues just when he is starting off on a gay time. I was going to write to razz him on that subject also. Mrs. Peakes and I spent a couple of weeks at Montego Bay a couple of years back, as part of recuperative treatment for her. Last weekend we spent at Atlantic City, where I was exhibiting one of my specialty stamp collections. I got an unimportant award, but also an experience of the kind that only happens to other people. We were walking from the jitney line to Captain Starn's for dinner when all of a sudden my wife dragged me down to the pavement. From behind us a man had sneaked up silently and tried to grab my wife's handbag. She fell to the ground but immediately knew what was happening and hung onto the bag so strongly that the frame was pulled off the leather body of the bag. By the time we got up off the ground we found that nothing from the bag was missing. The wife got a bruised knee, wrist and ribs, and is still in occasional pain when the injured places move. I only got a skinned knee and a heavily bruised elbow. I could see the man running away from us but never got a look except at his back. The police were called from the restaurant, but all they could do was take us to the hospital, then to the hotel. We had been having such a good weekend! Please, my regards to George Easter when you see him, and of course to yourself." He modestly refuses to tell what his philatelic award was, but I do know he has a valuable and rather famous stamp collection. Another snide remark about the use of class dues, ah, me!

Harold Pickering has been sick a long time in a Veteran's Hospital in Ithaca, N.Y. . . . **Virgil Wardwell,** retired, has been living in the same house for 54 years. He has four married children, eight grandchildren and two great-grandchildren. A fine family, Virge.

Pop Wood says his hobby is civil defense in his Peterboro, N.H. area and his travels are on his jeep, plowing snow up in that deep-freeze country. . . . When I received a change of address notice from the Alumni Association office on **Bahjat Abdulnour,** Course IV in Beirut, Lebanon, I wrote to him. In answer he wrote this wonderfully interesting letter, another example of this unusual Class and M.I.T. interest and devotion. This letter is really a rich reward to your Class Secretary. "An Arab saying: 'Mountain with mountain never meet; not so with ADAM'S sons, who will sometime meet.' So after 56 years I have the great delight of hearing from an old friend and acquaintance. Well, how are you all getting along? I presume like the destinies of life, some are fortunate, others try to be so. Now here is a succinct biography of one who is part of the mass of men who live out lives of quiet desperation (Henry Thoreau). 1919-1945—our country under French Colonial Mandate. We had a very poor time. Work abundant one year, then two to three years no work—so all profits gone with overhead, maintenance and general expenditures. 1945-1960—Independence! As you certainly would have been reading in the newspapers: wars, revolts, bombardments, upheavals, bank failures, insecurity. Nevertheless I did undertake some very interesting work during this period; however general conditions of the country obliged me to retire 11 years ago, subsiding on a decent pension from the Engineers and Architects Association. So now nearing the eighties and a bachelor, my only resort is to read again—the old Greek philosophies, which certainly render your mind more comfortable. I always receive and thoroughly read the President's yearly addresses and am proud of the achievements of M.I.T. men—especially those who traced the course of the astronauts to the moon and back to earth. I preach M.I.T. all over and by now some 20 young men have registered, graduated and have come back here and are all doing well. M.I.T. re-

quires no publicity. In closing, kindly convey my souvenirs to our mutual classmates and with best wishes to yourself. Under separate cover and through seamail, I have sent you a pamphlet of some of my works until 1939. Compared with U.S. buildings, these are zero, and really childish, but taking into account our very small country they were the best, at least around here. Building laws did not allow heights to exceed 22 meters."

After a stroke here in October 1966, **Eastie Weaver** suffered through a long siege of illness. In June 1967, he moved to Berkeley, Calif. to be near some of his family and died there on April 7. Some of us visited him in the hospital here and it was a pity to see how such a brilliant man's health had failed. . . . **Edmund R. Stearns** died March 31 in Essex Falls, N.J. The sympathy of our Class goes out to the families of these two men. Here endeth this year's column with my warm and friendly hopes for you all and your families to have a healthy and happy summer. Many thanks, many blessings for all you have done to "help Azel."—**Azel W. Mack,** Secretary, 100 Memorial Dr., Cambridge, Mass. 02142

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We regret to report the death of **Eric Schabacker** on April 23 at his home in Erie, Pa., following an illness of nearly two years. In his work, he dealt with artificial abrasives until 1922 when he became interested professionally in porcelain enamelling, and with Herbert Spencer, Sr., started a small independent manufacturing company, the Erie Enamelling Co., of which he was president until it was sold in 1944. Then in 1946, with an associate, he founded the Erie Ceramic Arts Company of which he was vice president until his death. As was also reported in the April 26 issue of the *Erie Daily Times,* "Mr. Schabacker was a member of the First United Methodist Church, the Rotary Club, the Hamot Hospital Board of Corporators and the Board of Directors of the Y.M.C.A." He is survived by his wife Maud Bailey Schabacker; a son Robert, U.S. Navy, retired; and four daughters.

In the 50th reunion Class History, Eric noted that, of his extra-curricular activities, what meant most to him was his "work as director of the local Y.M.C.A. and association with those in the organization." As for retirement, he noted: "Continue my activity in church and community and visit my five happily married children and the 23 grandchildren they have given us."

A release from the International Business Machines Corp. describing their elaborate computer exhibition at Madison Ave. and 57th St. in New York City lists an exhibit "showing the solution of general mathematical equations on **Van Bush**'s differential Analyser." Also, a quotation from Van's *Pieces of the Action* was used on the cover of *Computer Reviews* for March 1971. . . . Again, **Jim Evans,** who is busy teaching in the Patterson Vocational High School, sends us post cards from **Cy Guething** who spent much of the winter in Delray Beach, Fla. He notes that **Phil Baker** dropped in to say hello. Cy also sent us a clipping which starts out, "**C. A. Coleman,** (Dina to us) Lexington businessman who for almost half a century . . . has been active in community projects and services, today was honored with the Sertoma Club's 1970 Service to Mankind award." The article goes on to enumerate the many civic activities which Dina has promoted and administered. He is surely one of our most active and dedicated classmates.

A letter from **Maury Holland** to Bob O'Brien dated February 26 has been decoded (have you ever seen Maury's handwriting) as follows: "We've been at Fort Lauderdale since December 29, 1970, one block from the beach watching the passing parade of cruise ships going in to Port Everglades. On the other end of Seville Street is the Intercoastal Waterway where the jet-set of yachting gather in the palatial barges of the Fast Buck boys. A Chinese junk is the star. We have been revising my new book *Innovation—Key to Tomorrow,* the stories of Edison, Sperry, Kettering and independent inventors of Research and Development, the silent Partners of R/D, who contributed 62 major technological breakthroughs in this century. Heresy for Holland, the Founder of Independant Research Institute for R/D management. 250 companies doing 50 percent of all R/D in the U.S.A.; spending ten billion dollars to bring forth a mouse, or 200 pounds of rock at one million dollars an ounce! I'm also collaborating on another book, the *History of the Non-Profit Research Institutes,* Armour, Midwest, Southwest, Stamford, Cornell, Aero, etc. I served as advisor to four of them. My Chapter X titled "50 years in R/D Management" appears in Tom Slack's 'Southwest Institute Texas'."

Hal Larner writes another nice long letter from Long Beach, Calif., as follows: "Since the summer of 1961 my activities have been very limited as I was hospitalized in April of that year for a tongue irritation which eventually ended in extensive surgery. The operation cleared up the malignancy but left me with considerable stiffness and sensitivity in my right arm, shoulder and neck. This condition is not serious and I can live with it for quite some time but it is uncomfortable and most annoying. I have not been on any long trips since then. Eunice and I had reservations for a three-month tour of Western European countries during the spring of 1961 but my hospitalization canceled that out and we have given up all thoughts of making such a trip. At present my traveling is limited to the Southern California area. I still am able to handle an automobile and we take short trips frequently of about 50 to 60 miles but seldom stay away from home overnight For exercise I walk considerably, from three to four miles daily when the weather is favorable. I have not contacted any classmates for several years. Irving McDaniel lives relatively close by in Leisure World, Laguna Hills and I hear from him occasionally usually at Christmas and through mutual friends but I have not as yet had the opportunity to personally contact him. (Irv's death was noted in the March issue.—Sec.) We have two sons Hal, Jr. and Thomas Marshall both married. Hal, Jr. lives in Whittier, Calif., about 25 miles from Long Beach, has four children, three girls and a boy, ages 23, 20, 19, 14. Hal served in the navy as aviator during W.W. II and graduated from University of Illinois, aeronautical engineering in 1950. Since graduation he has been with Aluminum Company of America and is now junior executive in their Los Angeles office. Thomas Marshall lives in Oslo, Norway. He married a Norwegian girl and they have three children, two boys, ages 11, 5 and a girl age 8. Tom served as an officer in the Merchant Marine during W.W. II and graduated from California State College in Long Beach in 1952. He is now employed in teaching with the U.S. Overseas Teaching Staff and assigned to the Oslo, Norway area. Eunice and I celebrated our 50th wedding anniversary last year, June 5, 1970. I'm very poor in philosophy so you'll have to forgive me for skipping that topic. Information on the 55th reunion has just reached me and I'm sorry I can't be present. I will appreciate it if you will express Eunice's and my regrets at being unable to attend and our respects and best wishes to all classmates and their ladies."

From Palm Springs, Calif., **Francis Stern** writes about Irv McDaniel: "I have been in frequent touch with him all winter and knew of previous shocks. He seemed much better and his going was indeed a great surprise and a deep loss to me. Gladys and I phoned Kay, who seemed remarkably brave and her speech was excellent. We shall miss Irv who lent much color to every meeting we had together and I'm sure to every meeting he participated in. I hope to be able to come to New York on April 8 for the class luncheon although it will be close to my return from here (April 3). I have had a good winter—but Gladys got the worst case of flu possible and was terribly sick for three weeks. She is about back on her feet, though still needs a few pounds (to pick up those she lost)."

In late February, Sylvia and **Vert Young** drove to Jackson Miss., from their home in Bogalusa, La., to attend for the fifth time the Mississippi Gem and Mineral Show. They did not enter their rock exhibit for competition for it reached a point where it might discourage other exhibitors. They have had unusual opportunities to collect specimens during their several safaris and "rock-hunting" journeys in Africa, South America and "down under." Any '16er who gets near New Orleans and Bogalusa and doesn't stop to see Vert's extraordinary comprehensive collection has missed one of

Professor and Mrs. Walter G. Whitman, '17.

the 1916's too-little-heralded but most fascinating and colorful assets—a wonder of the rock collector's art! Here are a few morsels from Sylvia's most interesting account of the rock show in Jackson, in her typically-charming style: "The show is held on the Fair Grounds at Jackson, in large, well-lighted, spacious buildings. The display case allotted to V. Y.'s exhibit is like a large 'show window' and has to be entered from the back, a very difficult task and a back-breaking one. Cases in which to exhibit have to be made to fit into narrow spaces and the task would discourage the average person—but not Mr. Young. What he *is* always amazes me! To see him on his hands and knees, bending over trying to reach impossible places, under powerful electric lights which produce terrific heat, only goes to demonstrate that his successful career in life has always been proof of his tenacious patience and determination to overcome even the smallest difficulty! Our friends and relatives often wonder how we can endure three and four days and nights standing around the show, walking miles on concrete floors, as we examine exhibits, and talking to hundreds of people. Well, it is devastatingly brutal, but stimulatingly agreeable! Today is School Day at the show. Thousands of young people file and swarm through the buildings. The noise is deafening but normal, the behavior unusually controlled, and the 'picnic spirit' prevails; also an amazing demonstration of real interest in exhibits. Just now a man introduced me to his six-year-old grandson. 'Bobby, I want you to meet Mrs. Young.' Bobby looked me over, then looked up at his grandfather and said, 'She doesn't look young to me, Grandfather!' One can never tell what will be forthcoming."

A full reunion report will appear in the next issue.—**Harold F. Dodge,** Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046; or to **Leonard Stone,** Assistant Secretary, 34-16 85th St., Jackson Heights, N.Y. 11372

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At the time these notes are being compiled Martha and **Walter Whitman** are looking forward to the celebration of their 50th wedding anniversary on June 7, and all members of the Class will want to be included in the congratulations. We are indebted to John Mattill for the photograph of the Whitmans which appears in this issue and for his notes on a conversation he had with Professors Warren K. Lewis and Hoyt C. Hottel, who spent some time with him reminiscing about Walter's career. They pointed out that his association with the Department of Chemical Engineering dates back to immediately after his graduation. After World War I he became Director of one of the Practice School Stations; then was assistant to Robert E. Wilson as Head of the Department; and when Wilson left M.I.T. to join Standard Oil of Indiana, Walter went with him to become Standard's Assistant Director of Research, in 1925.

Some nine years later, upon Warren K. Lewis' decision to step from the head of the Department at M.I.T. Whitman was considered for the job and became Lewis' successor. He served with great distinction through 1961 when he chose to retire to become Science Advisor to the U.S. Secretary of State. Previously he had been on leave for two years as Chairman of the influential Research and Development Board; and for one year—1954—as Secretary General of the first United Nations Conference on the Peaceful Uses of the Atom. This was the conference first proposed by President Eisenhower in his address to the United Nations in 1953; and its form, organization, and management were due almost entirely to Whitman.

Quoting Mr. Mattill: "Both Professor Lewis and Professor Hottel were outspoken in praise of Professor Whitman; they described him as an 'intense worker' whose success derived in part from his ability to relax as intensively as he worked. 'One of his strongest attributes was his ability to inspire students and to instill confidence in them', Professor Lewis said. Clearly Professor Whitman is remembered with greatest affection throughout M.I.T., and he and Mrs. Whitman are both remembered fondly by their Concord, Mass. neighbors, where they lived throughout Professor Whitman's second tenure at M.I.T."

The Whitmans now make their retirement home in Scottsdale, Ariz. To them our very heartiest good wishes.

Items about numerous members of the Class have arrived from almost the four corners of the United States. This goes far to correct what **Warren Tapley** complains about when he writes on his Fund contribution envelope "I refuse to blow my own horn at this late date. There always seem to be the same names in the Class Notes and it is rather boring. I suppose they love it." All class secretaries agree with Warren on the first point of his complaint. With our secretaries from Stevens, McNeill, Proctor to the present the striving has been and is, to have news of more classmates. In spite of urgings, too many men just won't respond. By way of the Fund envelope flap and reunion return cards submitting notes can be done easily and even the most meager word is interesting to many. As for the second complaint it is safe to comment that nearly all news items come from other sources than the individual concerned; this often necessitates getting permission to use them. There have been occasions when a man has asked to be eliminated from the notes. The facts are that your secretaries are at your mercy and if you find your Class Notes boring, try sending in news of yourself and your classmates. . . . **David E. Waite** reports: "Celebrated Golden Wedding September 20, 1970 with a cruise to the Caribbean on the *New Amsterdam.* Took swims on the islands—had perfect weather. We had only one snowstorm this winter so have not been tempted to go South. Youngest granddaughter graduates this June from Dennison after spending one year in classrooms abroad in Spain. I read the Class Notes avidly."

Ossie Holt writes from San Ramon, Calif. that he enjoyed reading about the interim reunion in Northfield, and that he is trying hard to come East in June to see his sister in Concord.

Larry Gardner reports that after spending the Winter at New Smyrna Beach, Fla., "Dorothy and I are hoping that by April 15, when we are due to be back in Maine, the deep freeze will be over." . . . **Dick Whitney** apparently doesn't

Bing Crosby, wife Kathryn and daughter Mary Frances receiving appreciation plaque from National Society for Prevention of Blindness, presented by the Society's board chairman, Enos Curtin, '17.

have to worry about the weather. He informs us that living in Williamsburg, Va. is delightful, and hopes that any classmates coming there will phone him and stop by to visit. . . . **Bill Dennen** has reported on the completion of his trip after leaving the Fiesta in Mexico City. On their way home they stopped over with their son Dave who was recently promoted to Director, Antibiotic Development with Eli Lilly in Indianapolis, and Bill who was made Dean of Graduate Schools, University of Kentucky in addition to being Chairman of the Geology Department.

Bing Crosby, National Sight-Saving Chairman of the Society for the Prevention of Blindness for the past two years, was joined by his wife, actress Kathryn Crosby and daughter Mary Frances in a series of TV messages in behalf of sight preservation, and the three received an appreciation plaque from **Enos Curtin,** the Society's Board Chairman.

Our vice president on the Pacific Coast, **Howard Melvin,** attended the reception and dinner for Jim and Mrs. Killian on April 23 given by the San Francisco M.I.T. Club. As the only representative of what he believes was the earliest class present he properly wore his red jacket. He reports that it was a very nice affair, and that he was glad to meet Dr. Killian again. . . . Through Ray Stevens we also have news of **Alex Kenigsberg** who is planning another trip to Europe, probably Norway and Sweden; and of **Frank Peacock,** who spent a couple of months at Sarasota and Delray Beach. . . . Ray and **Phil Cristal** and their wives attended a very impressive and beautiful organ and piano recital at Memorial Services for **Ken Bell** at the Melvin Village Community Church. The recital which concluded with Weaver's "Bell Benedictus" served as a dedication of two Hammond tone chambers given the church by Vera Bell in Ken's memory. Among those present were great-grandson "Scotty" and Qwen and Ralph Flather, '21, the architect who designed Ken's home and camp.

With much regret we record the death of two of our classmates. **Irving C. Eaton** died on December 22, 1970. **Seldon Senter** died on February 11, 1971.

The following address changes have been reported: **George R. Duryea** has moved back to 251 Middlesex Rd., Buffalo, N.Y. 14216; Prof. **Alfred S. Niles** to 4608 Roland Ave., Baltimore, Md. 21210; and **Walter F. Pond,** Box 291 Greyfull, Wy. 82426.

You will enjoy two days in the Berkshire Hills if you attend the 1917—54th Reunion at Northfield Inn. Please note that the dates have been moved up one day to October 5 and 6. Our reunion site is a delightful place, the foliage will be lovely and the camaraderie will warm your heart. Plan to be there. . . . Only **Bill Neuberg** and your Assistant Secretary of the '17ers got to the May '16-'17 luncheon in New York with six '16ers in attendance, to-wit Joe Barker, Rudy Gruber, Walt Binger, Charley McCarthy, Herb Mendelsohn and Len Stone.—**Stanley C. Dunning,** Secretary, 6 Jason St., Arlington, Mass. 02174; **Richard O. Loengard,** Assistant Secretary, 21 East 87th Street, New York, N.Y. 10028

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I am presuming to use my prerogative as processor of these notes to make several editorial comments. I wish to stress to all of you that my work as your Secretary does not involve solicitation of funds. You are free and encouraged to write news to me at any time without any fear of embarrassment by way of such an appeal. Secondly, with regard to a very welcome letter to Len Levine from **Jim Sullivan** which follows in its entirety, I find his report very interesting and I think you all will agree with that verdict. Not all of us are destined to be presidents of large corporations but I am impressed by the stories from all of you which tell how each in his own way has contributed to his community both large and small. I am proud of my 1918 classmates and what they have done to make the world a better place in which to live since those days of 1914—1918. Here is Jim's note: "Dear Len: Yep, I'm the guy you played ball with at M.I.T. and at G.E. I remember you by name. I was also intrigued by your letter as I assumed it would be the usual appeal for funds. Frankly, it was a relief. Max Seltzer will edit that remark if he sees this. Briefly, after two years at Tech, the family went broke, so I worked in the G.E. Research Lab as an analytical chemist for $12 a week and after some months, joined the navy at $14 a week as a second-class seaman (there was nothing lower) and eventually served about four years on the U.S.S. *Makon,* a four-stacker destroyer, as an ensign—mostly as navigator. Then back to G.E. (Research and Fuel Quartz Department) for about 17 years. During the thirties with the Depression, I wasn't too happy about my jobs so took an exam for the Massachusetts Department of Labor. Six hundred took it, 18 passed and I got it. After a year, the Division of Employment Security came into being and after the Civil Service exams, I was again tops and became a district superintendent for the next 29 years. During the war, I was area director for the War Manpower Commission in Northeastern Massachusetts, forming committees of top management and labor in eight major cities of the area, controlling the availability and movement of all civilian workers, lots of speeches and grief. After the war, I had a five-month period as district superintendent in the Worcester area and then was transferred to Boston, which had a major problem in handling a case load of over 30,000 weekly (one-half G.E. and 52-20 Club), had it going smoothly in three weeks and was given charge of both employment and unemployment in Boston for about eight years. During my last several years, I was in charge of U.S. in metropolitan Boston, which included peripheral offices from Quincy, Framingham, Woburn, as well as Boston.

"I retired in 1966 and really retired. My wife of 40 years died in 1968 so I live alone and that is for the birds. We went to a class reunion (the 40th I think) at Claussen's Inn on the Cape and the 47th just outside of Osterville, mainly because my wife had several aunts and cousins in Osterville. I enjoyed it but I really only recognized Maggie Magoon. So many classmates are presidents of this or that and are always traveling around the world (I have spent two months in Europe, island-hopped in the Caribbean, been to Alaska and

California several times) that I feel outclassed. But then every set-up has a normal number of dopes, but I'm not very humble about it. Yours, Jim Sullivan, 1 Reed St., W. Lynn, Mass."

Here is welcome news from **Herb McNary.** "Along with the Board of Fire Underwriters I have also for quite awhile been helping to resuscitate the 80-year-old Massachusetts State Chamber of Commerce. This has included being Legislative Counsel. You picked up one of the press letters for the April *Review.* By coincidence while this was under '18, under '54 was an item on my son Dr. John McNary, and his being President of the American College in Paris. Maybe a father and son in the same issue of alumni notes is unique. Speaking of Jack, Marion and I are leaving to visit him in Paris in a couple of weeks but plan to be back June 4, and so expect to make the Homecoming, which somehow I associate with being able to be healthy and active. Yours, Herb McNary."

Selma and I were among those present at a lovely garden party May 15 at Elizabeth and **Julie Howe**'s—the occasion being their 50th wedding anniversary. It was a most pleasant afternoon enjoyed by their family and friends. . . . Later in the month I had lunch with Peter Strang and Fred Lehman of the Alumni office. Pete brought us up to date on his research on the effect of weather (such as sun spots and the earth magnetism) on the textile industry. He has just had some of his technical articles published in the Egyptian technical journals.

Granny Smith is a most faithful correspondent. He brings us up to date with this note. "We have an active M.I.T. Club here and last month had our annual picnic on Bill Grunwell's ('28) estate on Englewood Beach 50 miles south. We came by boat down the inland waterway, but most of the 60 members drove down over circuitous routes.

"After visiting my two sons and seven grandchildren we shall fly to Lisbon, Portugal, via Pan Am out of Miami, rent a car and explore the Algarve and southern Spain. In September we go on to Amsterdam to visit friends and tour the Scandinavian peninsula with a group from our church. Back here October 1 where our latch string is always out for visiting 18ers. My namesake, **Harold L. Smith,** Bradenton, Fla., had a stroke, and is not able to attend meetings. **H. V. Atwell** also lives in Bradenton, about 15 miles north of here. Weather here has been ideal for tourists but terrible for our citrus trees in the worst drought in history. Water is strictly rationed and we are allowed only a trickle now and then. Military affairs keep me busy—I have been head of the Disabled Officers Association for the past eight years and historian as well as chaplain (don't laugh) of the Military Order of World Wars. Looking forward to seeing you soon and with best regards. Sincerely, Granville B. Smith."

We are happy to report a happy note from **George Sackett,** now home after ten weeks in the hospital and making real progress in his health picture. George and I did our thesis together. I wandered far afield but as you can see, he has gone far, with great success in the chemistry of rubber. George writes: "I started out with Goodyear Tire in Akron where I was introduced to rubber chemistry. I went through chemical and physical testing, and ultimately into chemical manufacturing.

"In 1920 I got the idea that sales work might have some appeal and to my pleasant surprise the sales department felt I was suited to their needs and they signed me up for technical sales and sent me to Buffalo, N.Y. Here I met and later married the girl who has been my wife now for 48 years. Unfortunately Goodyear got into financial troubles and I had to find other work with a textile company near Taunton, Mass., but I returned to Akron in 1926, joining the Goodyear chemical engineering division and later went into tire compounding and then into research on accelerators and miscellaneous rubber chemicals, but particularly rubber itself, which at that time was all natural rubber. Goodyear then sent me to their rubber plantation in Sumatra as technical director and we spent the next three years there. It was a real experience. I had an opportunity to travel all over Java, Sumatra and Malaya, studying the methods of crude rubber manufacture and handling, and methods of making special rubbers. At the plantation I set up a very efficient system of latex handling and rubber manufacture. I also established a laboratory which I was delighted with as it gave me a chance to investigate some of the important problems of rubber quality. I returned to Akron in 1932, right in the middle of the depression.

An added bonus of the sojourn in Sumatra was the sight-seeing opportunity it afforded. We went out via the Pacific, giving us a chance to see Hawaii, Japan, Hong Kong and a short trip inland into China and Shanghai, the Philippines, and Singapore. On our return trip we came through Europe, giving us six weeks in Egypt, Italy, France, England and Belgium. We had a week's stay with friends on the French Riviera including Monte Carlo. In Akron I was in charge of processing and tire manufacture at the passenger tire plant. In the meantime I continued my studies on crude rubber and gave a couple of papers before the American Chemical Society and served as a member and ultimately chairman of the Crude Rubber Committee of the A.C.S. which set up quality standards for crude rubber and proposed a number of ideas which were later adopted by the industry. After several years the war came along and I was transferred to a special section working on synthetic rubber. Later I responded to a request to supervise the compounding and manufacture of retreading and repair materials made in several of the Goodyear plants, so considerable travelling was involved and I travelled into nearly every state in the U.S.A. doing this work. As a part of my work I became a member of industry committees such as the Ordnance Advisory and also the Retread Materials Committee of the Rubber Manufacturer's Association. I was chairman of this latter committee for 15 years, until retirement. In the meantime, I had an offer from Armstrong Rubber Company to head up their Retread Materials Department which I could not refuse. I came to Connecticut in 1955 and I have been here ever since.

"I retired in 1966 and I still live in Milford, Conn. where I can see the waters of Long Island Sound from my front window and breathe the clean air from the ocean. In 1932 we had a daughter who was married in 1955. She and her husband moved to Rhode Island several years later and they have five fine children who have given us much pleasure. Since my retirement I have been doing consulting work for the National Tire Dealers and Retreaders Association. This work is mainly revisions of standard manuals, discussions of quality standards and reviews of the Association's big shows each year. It has also meant meetings with industry technical men and articles for retreading journals. All very interesting, but not so arduous or time consuming that I do not have time to travel and to do some simple gardening."

Len Levine reports he talked to **Eddie Rogal** by phone recently. We thought he had moved to California but he is still in North Scituate. He is retired from having worked most of his life on a stock control system for department and large stores. He has successfully obtained many patents on same. . . . Thanks to Len, here is a note from **Bob Gidley.** "Dear Leonard, Of course I remember you; we were at the Navy Yard together, and I shall always look back on our training course there as a memorable and unique experience. I learned a lot while taking the course but I am afraid I have forgotten much of my naval architecture experience since 1918. But I do have my ship model on the wall in my home and often look at it and wonder how I ever got it to Texas without the slightest damage. I am retired and in my 79th year. Have now lived at my present address since 1940 in a house which I designed and still find it meets my family needs very well. Have two married daughters, eight grandchildren and two great-grandchildren, a boy and a girl. Max has been making such an effort to get in the news of our classmates and making such a success of it that I finally sent him the story of my activities since leaving M.I.T. I appreciate your offer to send in my 'This is Your Life' but it already has appeared in *Technology Review*—about two columns in the October-November 1970 issue. Like you, I always enjoy news of classmates and try to keep in touch. Leon Keach (he was 1917 not 1918 but we were at the Yard together)

exchanges letters every now and then and always at Christmas. We used to go mountain climbing together when I was with J. William Beal in Boston.

"I taught architectural plan reading in Boston (Franklin Union evening courses) but that was back before the big depression. I switched to advertising when I came to Texas and remained in this field until retirement. Will be happy to hear from you at any time. Letters from M.I.T. classmates are getting to be few and too far between. With my very best regards. Sincerely, Bob Gidley."

Sometimes our letters to some of you arrive too late—in this case, Len Levine's note to **Leo McNally:** "Dear Mr. Levine, your letter to my father, Leo McNally, was forwarded here. I'm sorry to say he died October 22, 1962. Until his retirement, he served as Superintendent of Public School Building and Grounds in Fall River, Mass., and for many years was associated with the McNally Construction Co. He died in Boca Raton, Fla., where he owned a home. Among other activities, he served as a member of the Boca Raton Planning Board. While at M.I.T., he joined the Harvard Regiment (R.O.T.C.) and the Navy Air Corps (Lighter-than Air), from which he was honorably discharged as a Lieutenant j.g. He saw service in France, England and Ireland. He married my mother, Emma Barlow in 1921. He is survived by my mother, eight children and 21 grandchildren."

The following are new addresses: Giles D. Hulseman, C-102 Lake Lotawana, Lees Summit, Missouri; Henry C. Stephens, 1412 Buena Vista, Apt. 3, San Clemente, Calif.; William Weiscopf, Nassau House, 301 North Ocean Blvd., Pompano Beach, Fla.; Sumner Wiley, R.F.D. #1 South Harpswell, Maine.

Keep the news coming to us.—**Max Seltzer,** Secretary, 60 Longwood Ave., Brookline, Mass. 02146; **Len Levine,** Assistant Secretary, 3 Greenway Court, Brookline, Mass.

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Letters from Mrs. **Karl F.** (Allegra H.) **Rodgers** and Paul W. Blye told of the passing of Karl on March 27, 1971 at the Peter Bent Brigham Hospital in Boston after an operation following only a very few days of illness. Karl missed seeing his fifth grandchild and first granddaughter by less than two weeks. Karl was retired in 1960 as a member of the Transmission Systems Development Department at Murray Hill, N.J., Bell Telephone Labs after 39 years with them. He is survived by his wife, a daughter, Mrs. Robert D. Morton, and a son Karl, Jr., a member of the technical staff at Murray Hill Labs. Karl wrote one of the chapters of our "25 Years After" booklet and was always on hand for the class affairs around New York and elsewhere.

Paul Blye and Esther spent March on Sanibel Island, Fla. They still have their home in Chatham, N.J. at 53 Dale Dr. and their summer place at Cranberry Lake, N.J. They have given up their long trips and now stay rather close to home. They take a short trip to Sugar Hill, N.H. the first week in October for the beautiful foliage.

We recently received a postcard from **Ev Doten** from Hong Kong where he and Iva were visiting on a trip to the Orient. They had an informal 1919 fifty-second reunion with **P.K. Hu** and **Shee Lee** in Taiwan. Their itinerary took them to Bangkok and Bali and it sounded like a wonderful trip.

Address changes follow: Jacob J. Bolotin, 3512 N. Second St., Harrisburg, Pa., Raymond H. Dearden, 955 Wilbur Ave., Somerset, Maine. Captain Edward E. Saunders, 6251 Old Dominion Dr., McLean, Va.

Best wishes to the class from your secretary and please send in some notes about yourself, family and classmates.—**E. R. Smoley,** Secretary, 50 East Rd., Delray Beach, Fla. 33444 (Tel. 305 278-4537)

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A heartwarming note from **Sam Schenberg** accompanies his notice of a change of address from Brooklyn, N.Y., to Oceanside Plaza, 5555 Collins Ave., Miami Beach. Sam says: "I retired as the Director of Science of the New York City schools on September 1, 1969. At that time the Environmental Resource Council was organized to articulate the offerings of the major science resource agencies in New York City with the science program in our schools. This resulted in a publication *Science Trips* which was distributed to all elementary school teachers in the city. We are now preparing a second publication, *Adventures on the Beach* to supplement the first one. We hope to make the beach along the Atlantic a huge laboratory for elementary and high school students. This work was undertaken as a public service and I have enjoyed every minute of it. Ruth and I decided that I could continue such operations in a warmer climate so we have decided to join our many friends in Miami Beach. We are in excellent health and I hope the other members of our class are in the same state." It goes without saying that Sam's notable career and significant contributions to education reflect great credit on our class. More power to him!

From another eminent Course X man comes this welcome report from the Philippines. **Harry Kahn** writes: "I am now on my third trip to the Philippines since 1967, totaling 17 months as an 'Executive Volunteer' for the International Executive Service Corps to aid production in a tile plant here, Fil-Hispano Ceramics. On our way home from these assignments, Hannah and I do a little sightseeing, visiting such places as Iran, Israel, Turkey, Greece, Austria, France, England, Bali, Singapore, Hong Kong, Taiwan, Tokyo, Honolulu, Bangkok, India, Rome, Switzerland, Germany, Italy, Holland, and on this trip, Spain and Portugal." How's that, you eminent globe-trotters of the Class?

Harry says that during this visit to the Philippines he and Hannah were guests of honor at the M.I.T. Club in Makati, a suburb of Manila, attended by some thirty alumni and wives. The club has about a hundred members and Harry has met most of them—"all good engineers and proud of M.I.T." says Harry. "We do have another M.I.T. college here, started by Oscar B. Mapua, '41, and naturally called Mapua Institute of Technology." Harry remarks that most of the men here were Course X. He sends regards to all members of the Class.

We can't help wondering if Harry and Hannah didn't run into still another Course X classmate during their trip to Spain since we received a card just the other day from Marie and **Phil Byrne,** reminding us of our happy meeting with them in Madrid a few years ago. This one, written from Segovia, says "Here we are again, seeing more of beautiful Spain." What a grand and spirited couple, those Byrnes. . . . Your secretary had the pleasure of seeing **Henry Hills** at a recent luncheon meeting of the M.I.T. Club of Boston and is pleased to report that Henry is as full of the old beans as ever, and has lost none of that booming chuckle of his.

Now, reluctantly, for a report on several grievous losses to our Class. **Ben Hopkins** passed away in March. He lived at 2952 Kendale Dr., Toledo, Ohio, and is survived by his wife, Laura, and a daughter. Ben served as electrical engineer for Toledo Edison Co. for many years. Upon retirement he taught business administration at the University of Toledo.

Medwin Matthews died last April. His home was at 79 High Plain Road in Andover, Mass., and he is survived by his wife, Pearl, a daughter and three grandchildren. The Matthews lost a son who resided in Bagdad and who left them twin sons, now living in Cumberland, R.I. Med was an executive design engineer for the Board of Water Supply in New York City for 37 years, retiring in 1967. He moved to Andover where he busied himself restoring and remodeling an old homestead. He was a member of the Society of Professional Engineers.

Jimmy Moir died in March at his home, 8 Alden Rd., Wellesley Hills. He leaves his wife, Marion, a daughter, son and eight grandchildren. Jimmy had been in poor health for some time, missing the 50th on that account. In 1963 he retired as chief engineer of the New England Telephone Co. Long a citizen of Wellesley, he served on the Wellesley

H. R. Kurth, '21

H. F. MacMillin, '21

Advisory Committee and had been a town meeting member. He belonged to the Wellesley Club and the Telephone Pioneers of America. He had many staunch friends among his classmates and will be sorely missed.

In January of this year, Vice Admiral **Frederick W. Pennoyer** died. He lived in Coronado, Calif., at 700 Margarita Ave. . . . New addresses for classmates: Joe Mahan, 29607 Gleneagles Rd., Perrysburg, Ohio; Nick Smoley, 805 Three Rivers North, Ft. Wayne, Ind. . . . More about last June's Alumni Day and those present in next month's issue.—**Harold Bugbee,** Secretary, 21 Everell Rd., Winchester, Mass. 01890

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The appearance of this issue of the *Review* marks 50 years of leadership of the Class of '21 by Class President **Raymond A. St. Laurent.** We salute him on behalf of the Class! It also marks your Secretary's completion of a half-century of reporting your doings for these pages. We both thank all who have aided us—officers, committeemen and others of the Class. It has been Ray's devoted efforts, original ideas and creative "firsts" which have made Class and M.I.T. history. They strengthened the bonds of fellowship, elevating the Class to a leading position as a social group and a positive force for the benefit of the Institute. The '21 Golden Anniversary celebration in June recognized Class achievement amidst top-notch entertainment. An account will appear in the September *Review*. You're assured of receiving this and other important Class news throughout the coming year if you have sent your annual gift to the Amity Fund.

Editorial enrichment

Your Secretary was accorded a unique privilege in being invited by *Review* Editor John I. Mattill to sit in on the impressive deliberations of the magazine's prestigious Editorial Advisory Board. We shall endeavor to prepare a report for the annual Class Secretaries' Workshop in the fall. Our trip, accompanied by Maxine, provided delightful opportunities for overnight stops with Helen and Class President **Ray St. Laurent** in Manchester, Conn., and with Maida and Class Agent **Ed Dubé** in Reading, Mass. Just before we left, we had a grand visit from Ruth and Class Vice President **Irv Jakobson** who stayed overnight with us in Brielle.

Saul M. Silverstein, Erdoni Rd., Columbia, Conn. 06237, retired chairman of Rogers Corp. turned writer, traveler and lecturer, is the author of another article in the May 1971 English edition of *P.H.P.* Magazine, "Save Heat for Chilly Days." A card featuring Mt. Fuji and cherry blossoms, just received from Saul in Tokyo, says: "Still planning to make it to the reunion but getting too close for comfort. Due back in Belgium and Malta right after our 50th."

Your letters say . . .

"May warmup for our 50th on a cruise to Bermuda," is the terse comment from Kay and **Edwin F. Delany,** 8 Welgate Circle, Wollaston, Mass. 02170. . . . "Looking for a retirement home. Am vacationing in St. Petersburg, Fla.," writes **Benjamin F. Williams,** 220 Douglas St., Portland, Maine 04102, owner of Williams Storage and Loan Co., Portland. Send in the data sheet, Ben! . . . **O. Kenneth Bates,** 44 East Main St., Canton, N.Y. 13617, former head of the Mathematics Department, St. Lawrence University, says: "Greatly enjoy retirement since 1967. Recently rode in a hovercraft and a helicopter on the same day. Travel extensively and have camped in Western U.S.A. and Canada. Since our graduation, taught 12 years at M.I.T. and 34 at St. Lawrence. Have three daughters and a son, all with graduate degrees, and 11 grandchildren of whom two are in college." . . . Muriel and **George F. B. Owens,** P.O. Box 3025, Vero Beach, Fla. 32960, sent regrets at not being able to attend our 50th on account of doctor's orders. Data sheet please, George!

Carl W. Hammond, 1107 Mariposa Dr., Vallejo, Calif. 94590, retired safety engineer of Mare Island Naval Shipyard, writes he and Henrietta are looking forward to reunion attendance. . . . **Harrol W. Baker,** 17826 Clifton Blvd., Lakewood, Ohio 44107, retired chairman of Baker Laboratories, Cleveland, tells of a trip to England in June to visit relatives. Wish we had your data sheet, Harrol! . . . **Raymond C. Fisher,** 5109 N.E. Latimer Pl., Seattle, Wash. 98105, remarks: "I have remained in electronics or communications ever since graduation. Retired from Boeing in 1958. In 1949, I married Margery Charnley of Seattle. We spend October to March at our home in Carmel, Calif."

Double retirements

Henry R. Kurth, 63 Pleasant St., P.O. Box 894, Wolfeboro, N.H. 02894, retired Boston Edison vice president, has now retired from his later consulting work with Jackson and Moreland. He notes the pleasure of "moving from the jungle of Boston to the cleanliness of the New Hampshire lakes and mountains" but says it has been complicated by an eye problem "which has been arrested but not resolved." Chick adds: "Laura and I are living on top of a hill overlooking Lake Winnepesaukee and the mountains. We hope you will come visit us." He earns our kudos on two counts: as a great-grandfather and for having served the Class of '21 for all these 50 years since graduation as our representative on the Alumni Council.

Edward F. Praetz, 101 Knox St., Lawrence, Mass. 01841, writes: "Retired in June 1970 as the head of the Mathematics Department of Lawrence High School. Toured the West with Marcella and the family of one of our three daughters. I was invited to teach freshman mathematics for the 1970-71 year at Merrimack College and will retire again this June."

In Memoriam

With heavy heart we record the passing of eight of our members and express to their dear ones the sympathy of the entire Class.

Louis Daniel Striebel, Restwood, Long Beach, Michigan City, Ind. 46360, died June 16, 1969. Born in Michigan City on January 8, 1896, he attended Purdue, joining us in Course II in the junior year. He was a member of Sigma Alpha Epsilon and the Mechanical Engineering Society. He had been vice president of the Allsworth Striebel Corp., Chicago, before retiring.

William Clarence Colley, 105 Sterling Court, Nashville, Tenn. 37212, died January 10, 1971. He was associated with us in Course IV and spent his professional life with the architectural firm of C. K. Colley and Co., Nashville. He served as an Army captain in World War II and had been a member of Phi Delta Theta at Vanderbilt University.

Milford Phillips Graham, 33 Carolan Ave., Hampton, N.H. 03842, died January 24, 1971. A native of Waltham, Mass., he was a student in Course X and a private in the S.A.T.C. at M.I.T. in World War I. Retired, he had been associated with the Boston Manufacturing Co., Waltham, and the Boston offices of Newport Chemical Works, Calco Chemical Co. and American Cyanamid Co. He is survived by his wife.

Lawrence Castonguay, 1367 N.W. 4th Ave., Boca Raton, Fla. 33432, died March 24, 1971. Born in Thompsonville, Conn., June 25, 1896, he attended Carnegie Tech, joining Course II in the junior year. He was a World War I veteran and member of the Mechanical Engineering Society and Catholic Club at M.I.T. He retired in 1961 after 36 years as a design engineer for Pratt and Whitney, East Hartford, Conn. We are indebted to Ray St. Laurent for data to prepare these notes.

David Robert Merrill, 425 Chestnut St., Moorestown, N.J. 08057, died April 4, 1971. An associate in the Research Laboratory of Applied Chemistry at M.I.T., he was in Course X. He was manager of research for Union Oil Co., California, and later chief development engineer, Rohm and Haas Co., Bristol, Pa.

Ralph Waldo Wood, 24 Holbrook Ave., Rumford, R.I. 02916, died April 18, 1971. At M.I.T. he was in Course XV and a private in the S.A.T.C. He had been a civilian engineer with the U.S. Navy, a Mason and past master of St. John's Lodge. Surviving are his wife, Lucile; two sons, a brother, Walter C. Wood, M.I.T. '17, and six grandchildren. We are indebted to classmate Al Lloyd and to Norris G. Abbott, Jr., '20, for supplying information.

Howard Francis MacMillin, 840 Tower Rd., Winnetka, Ill. 60093, died May 1, 1971. He and Corinne planned to attend our 50th per his letter last February, which was followed by her April note that his month's hospitalization made it impossible. Born in Mt. Gilead, Ohio, November 11, 1897, he came to Course II from the College of Wooster. At M.I.T. he was a member of Kappa Sigma, the Mechanical Engineering and Radio Societies, Technique '20 and '21, and a seaman in the S.N.T.C. A 50-year pioneer in fluid power and hydraulic plastic molding equipment, he founded the MacMillin Hydraulic Engineering Corp., Skokie, Ill., and was president and general manager until turning the firm over to two sons on semi-retirement as chairman and treasurer. Earlier he had been president and general manager of the then Hydraulic Press Manufacturing Co., a Mt. Gilead firm started by his father. Besides his wife, he is survived by three sons, a daughter and 13 grandchildren. We express sincere appreciation to Mrs. MacMillin for her kind letters and to Alvin Guttag, Secretary of the Class of '40, for a clipping from the *Washington Post.*

Harold Frederick Stose, 20 Center St., Yarmouth Port, Mass. 02675, died May 13, 1971. Born April 1, 1898, in Washington, D.C., he was a son of the late George W. Stose, M.I.T. '93, and brother of Charles W. Stose, '22. Graduated with us in Course XIV, he earned the S.M. in Course X-A and was an instructor at M.I.T. in 1922-23. He had been a member of the Chemical and Electrical Engineering Societies, the staffs of *Technology Monthly* and *Tech Engineering News* and the tug-o-war team. A fellow of the American Association for the Advancement of Science, he was a materials research engineer on plastics, U.S. Army Research Laboratories, Natick, Mass. He is also survived by his wife, Louisa. Classmates Bob Miller and George Chutter attended the memorial service.

Summer reminder

We urgently need your letters and beg you to return the questionnaire forming the last page of the Class Directory, together with your photo, if you haven't done so. A happy, healthy summer to you and yours.—**Carole A. Clarke,** Secretary, 608 Union Lane, Brielle, N.J. 08730; **Edwin T. Steffian,** Assistant Secretary, Steffian, Steffian and Bradley, Inc., 19 Temple Place, Boston, Mass. 02111; **Sumner Hayward,** Assistant Secretary, 224 Richards Road, Ridgewood, N.J. 07450

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Under the heading of things that never happen and nothing is as easy to do as it looks comes the fact that for the first time in 40 years the ice in Lake Erie refuses to be blown down the Niagara River. As a consequence our Buffalo summer swimming will start on the Fourth of July. However, golfing conditions are excellent, so do drop in!

Verbal accounts of the March Fiesta in Mexico City report excellence in entertainment and hospitality. We were in New Orleans early in May to find a very friendly reception by the Mayor and had the pleasure of being made an Honorary Citizen of the International City. Our next trip is to Iowa State University where your secretary will receive the Distinguished Achievement Citation. Then to return to Buffalo to continue the exciting challenge of working for a living at Ferguson Electric. . . . Frances and **Albert Sargent** of Melrose thoughtfully sent beautiful postcards from Acapulco reporting their delightful vacation and trip to Taxco and Mexico City. We hope they saw the famous Anthropology Museum. They were in Hawaii last December attending the annual conference of Health, Welfare and Pension Funds. . . . **Bertha S. Dodge** is president of the League of Vermont writers continuing her previous career as writer for the American Society of Tool and Manufacturing Engineers of Dearborn. Her postmark indicates Burlington, Vt. She has completed six non-fiction books and miscellaneous articles. We hope she joins us at the 50th.

Randall W. Meech has retired as defense contract auditor in the Los Angeles region and now lives in Pasadena. Last year the Meeches visited the Boston area where they enjoyed walking around M.I.T., the Harvard Yard and

Commonwealth Ave., to the Kenmore station. Many of us enjoy these nostalgic experiences and have even included the circle of cobblestones at the site of the Boston Massacre. . . . **Oscar Horovitz** has been invited to become one of a small organizing group to discuss the establishment of The Friends of the Arts at M.I.T. He will keep us posted regarding these activities.

We previously noted the death of **Edward A. Larner** of Amherst, N.H., and Beacon St., Boston. He was formerly executive head of the Employers Group of Insurance Companies. He was a veteran of World War I and after several years of experience was elected vice president of the Employers Fire Insurance Co. In 1947 he was elected president of the American Employers Insurance Co. He had also been chairman of the U.S.A. Investment Advisory Commission of the British owned affiliates. Surviving him are his wife Mary, three sons, Marshall P. of Duxbury, Edward A. Jr., and Chester C. of Concord, a daughter, Mrs. Priscilla McEwen of Lexington and two brothers, Herbert B. Larner of Montclair, N.J., and Captain Harold Larner USN (Ret.) of Long Beach, Calif.

Frank Kurtz of DelRay reported the funeral services of **Harry E. Rockefeller** in May. Harry had not been well for a few months prior to his death. He is survived by his wife Vera, two daughters, two brothers and a sister.

Carlys and **Frank Kurtz** are planning a trip in September on the *Hamburg* to the Mediterranean and Black Sea from which they will return by air. . . . Robert H. Johnson '26, chairman and chief exective officer of Ingersoll-Rand Co. forwarded a clipping reporting the death in February of **John F. Ryan** of Pelham, which we previously had noted. John was a native of New York City and after M.I.T. he attended Fordham Law School. He was admitted to the Bar in 1929. During World War II he was a commander in the Coast Guard Auxiliary and later served as town councilman in Pelham. He is survived by his wife and a son William.

We received a most friendly letter from Margaret Spalding of Cincinnati telling of the sudden death on January 1 of **Francis W. Spalding,** whom we knew as "Dyno". "Skipper," "Dyno" or F. Wheeler Spalding was a privileged character with Proctor and Gamble for 37 years. His associates said that "more than any other engineer, he knew about refrigeration and air conditioning and how to apply such knowledge to the design of a system for a given application. He was a master at transferring knowledge from his brain to a piece of paper, knowing exactly what he wanted in a design. He was an indefatigable worker who seemed happiest when asked to perform the impossible. Yet he was also a gregarious man who would cheerfully take time to explain some technical point to one of his fledgling associates and share with them his wide reservoir of skill and experience. His contribution to the company and to the men he trained will not be forgotten." "Dyno" was active in many engineering organizations and in the Greater Cincinnati Tree Council. His daughter, Mrs. Carol S. Nagel of Cincinnati, has two children. Mrs. Spalding sends regards to many friends in the Class.

Among the changes of address are E. Irving Bell, 2nd, Ft. Lauderdale, Fla.; Ray C. Burrus, Hallandale, Fla.; Chauncey E. Eaton, Westmont, Ill.; Dr. Lucius W. Elder, Jr., Northport, N.Y.; Robert L. Hallock, Boca Raton, Fla.; Allen H. Kidder, Lansdowne, Pa.; Kenneth B. Lacy, Highland Park, Ill.

Be sure to read next month's notes reporting on Alumni Day activities in June as we hope to see you there in good health.—**Whitworth Ferguson,** Secretary, 333 Ellicott St., Buffalo, N.Y. 14203; **Oscar Horovitz,** Assistant Secretary, 45 Gerard St., Boston, Mass. 02119

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It is with regret that I begin these notes with an item of sadness. I have recently been informed of the passing of **Howard Russell**'s wife, Mildred. The sympathy of the Class goes out to Howard, our recent president, who moved to Arizona partly for the reason of assuring her improved health.

Thomas E. Rounds has just returned from a trip south with his wife. They visited Charleston, S.C., Williamsburg, Va., and other places. During the trip they had a visit with Phyllis and **Dave Davenport.** Tom tells me that the Class History is well in hand, and some 800 autobiographies are now being edited. If any of you 23ers have a glossy print or a negative of yourself which is not too frightening, please forward same to Dave for possible inclusion in the History. His address is 109 Bay Dr., Linkhorn Park, Virginia Beach, Va. 23451.

Norman Weiss wrote me an interesting letter which included an account of his recent illness. Due to a change in plans of one of his clients, he had to make a hurry-up trip to London, South Africa and Spain, and covered 30,000 miles in a short time. He knew something was wrong because he felt so tired. Soon thereafter he suffered a stomach hemorrhage from an ulcer, and, while in the hospital, a coronary (his first). Although his doctor now permits him to resume normal activities, he still has the same old spirit to keep busy, but has curtailed some of his consulting schedules. He states that he and May are certainly planning to attend our 50th Class Reunion in 1973.

A letter from **Herb Hayden** to **George Johnson,** our class president, tells that Herb and Katie have been in Florida for several weeks and they will take off for a five-month trip in the Pacific area about the first of August. Herb states that our reunion in 1973 will be from May 31 to June 4, and he hopes to have a meeting of the Reunion Committee just after the Alumni Day activities in 1972. Subject to the approval of class president Johnson, and to their acceptances, Herb names our 50th Reunion Committee as follows: Al Allen, Ray Bond, Charlie Burke, Phil Coleman, Dave Davenport, Walt Dietz, Rod Goetchius, Earle Griswold, Bob Hershey, Forry Lange, Charlie Mapes, Pete Pennypacker, Tom Rounds, Eddie Schmitz, Dave Skinner, Roy Sterling, Lem Tremaine and Jack Zimmerman.

A communication from **Hugh D. Chase** states that he has retired in Atlanta, Ga., from the State Highway Department, and has moved to Quincy. . . . **Edmund H. Miller** reports that his 25 grandchildren, ranging in age from one year to 21, bring him broad interest and perspective. He is still working with the Rocks Fern Croft Guild in Rochester, N.Y., on projects for spiritual education. . . . The following classmates attended the 1971 M.I.T. Mexico City Club Fiesta: **Cecil H. Green,** Dallas, Texas; Grace and **Ray Holden** of Sarasota, Fla.; and **Fernando de la Macorra** of Mexico City.

We have been receiving official records of some of our classmates who have made careers in military service. A few of their activities are given herewith. Fuller accounts will be included in our forth-coming Class History. Rear Admiral **Calvin M. Bolster** had war service in 1917, 18: on U.S.S. *Texas* and U.S.S. *New Jersey:* Lieutenant, Lieutenant-Commander, 1934; Commander 1939; Captain 1942; Rear Admiral to date; Retired List of U.S. Navy, Jan. 1, 1954. Received many decorations for meritorious service. Is a Fellow of the Institute of Aeronautical Sciences and the American Rocket Society. Home address is 27 East Avondale Ave., Youngstown, Ohio. . . . Rear Admiral **Charles David Williams:** Enlisted in U.S. Naval Reserve. Lieutenant; Captain 1943: On February 1, 1950 placed on the Retired List with the rank of Rear Admiral. Married Catherine Beck Williams. Two daughters and a son. Home address: 32 Moss Ave., Highland Park 3, Mich. . . . Captain **Roswell Belden Daggett,** U.S. Navy. Naval Academy. Served on U.S.S. *Minnesota.* Bureau of Construction and Repair, Navy Department, Washington, D.C., until 1931; Superintending Constructor's Office, Bethlehem Shipbuilding, Quincy, Mass., until 1935. Ship-Outfitting duty during World War II: Naval Shipyard, Pearl Harbor, 1945. Captain to date from June 18, 1942. Address is Springfield, Mass. . . . Captain **Walter Frederick Christmas,** U.S. Navy. Naval Academy; Master of Science from M.I.T. in 1923; Inspector of Construction at New York Shipbuilding Co.; Served on U.S.S. *Saratoga;* Head of Maintenance Branch, Bureau of Ships, Washington, D.C.; Supervisor of Shipbuilding at San

Pedro, Calif.; Home address: 3342 Tennyson St., N.W., Washington, D.C.

I would appreciate hearing from any of you members of our "silent majority."—**James A. Pennypacker,** Assistant Secretary, Long Hill Rd., Essex, Conn. 06426

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In the June *Review,* my approach to the Class Notes was by the numbers. This time, it shall be by date of receipt of news, probably frowned on by Course XV men, but simple to a Course I renegade. From Los Angeles, **Frank E. Reeves** writes that he retired at the end of 1970. A professional and registered electrical engineer in four states and member of nine organizations, he continues to be very busy and to enjoy association with friends as executive director of the Los Angeles Council of Engineers and Scientists and executive manager of the Institute for the Advancement of Engineering. The I.A.E. is a non-profit, voluntary corporation conceived in Los Angeles primarily to advance the welfare of the general public by meetings and exhibitions explaining the pressing need and application of engineering to the workings of every day life. The I.A.E. has established the grade of "Fellow of the Institute" which recognizes unselfish work in the technical societies and advancing engineering, rather than technical accomplishments. A "College of Fellows" is about to study the cost of eliminating 90 per cent of all pollution in Southern California as an initial project. They will go so far as to suggest methods of paying the cost. A most helpful guide would be the paperback "Man's Impact on the Global Environment," a report of the Study of Critical Environmental Problems (S.C.E.P.) sponsored by M.I.T.

We missed **Paul Cardinal** at Homecoming. On June 7 in New York, he was presented a silver tray "for outstanding service" as an I.E.S.C. Volunteer Executive Recruiter. He has recruited 50 former executives for foreign service in the fields of drugs, liquor, safety engineering and hotel managing. Paul is very qualified for this task as a former vice president of Hoffmann-LaRoche and consultant on nutritional science at Columbia University. . . . **Everett Elting** will also receive recognition for outstanding performance at the same ceremony conducted by the International Executive Service Corps. Ev is a hosiery expert and certainly must have developed a panty hose computer complementary to his background in chemistry.

A good letter from **Max Ilfeld** in Albuquerque, N.M., last heard from just before our 45th Anniversary when he signified every intention of swinging clubs at Bald Peak, but did not make it. He has retired from his own building materials business formed after military service and construction experience (a civil engineer). Never much of a joiner at the Institute, it appears that he changed later. At one time, he was Dance Chairman of the Dormitory Executive Committee and *Technique* reports that the dances were always successful, a sort of institution affording a most pleasant evening. No report on his capability at the Charleston.

Max retains his sense of humor by stating that he will read ye scribe's Notes for 47 years more just as he has enjoyed Chick Kane's for a similar period. He also asks indulgence for typing errors as he finds his "new electric machine much faster on the draw and maybe a bit smarter." Plays golf all year 'round, pulling a cart "as I am not old enough for an electric buggy, but can feel the day coming." He continues to travel extensively, especially on 12-passenger freighters, last Fall's episode being from San Francisco to Rotterdam (30 days nonstop) with 6 weeks in the British Isles, finalized by flying home. The most serious drought in his memory will make crops a complete failure; and sheep and cattle are fed with imported rations or shipped out of state.

Word has been received from **Nish Cornish** in Mexico City that **Thomas M. Nevin** (Jack) died there on May 17, 1971. Son John and daughter Ann from the States joined son David and Gerry for religious services. Nish and several M.I.T. Club members attended. At one time, he was president of the club. During World War I, he saw service in France and Italy. Aware of the opportunities in Mexico, he set up his own company there in 1943. Jack's associates and employees in the North American Institute of Cultural Relations expressed their deep sorrow at the passing of their companion and friend in a sizeable notice in a Mexico City newspaper. The Class extends its sympathy to Gerry and the family.

Nish advises that the mail service in Mexico City has been very slow recently, as much as 10 days for local delivery and two to three weeks, at times, from the States. He hopes that our new Post Office regime will correct the difficulty, but I suspect that mini-sized sombreros would permit better zip scanning and body movement, by our southern neighbors.—**Russell W. Ambach,** Secretary, 135 Aspinwall Ave., Brookline, Mass. 02146

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Shedd Vandenberg writes from Rancho Santa Fe, Calif., "Our move here from Wellesley Hills was decided after five years of winter searching for a good all-year area (people, climate, charm, and rural) to retire to. This we hope is it. It's been great so far; three golf courses within five miles where I can hack with with my wife and friends." . . . **Calvin A.** (Tink) **Campbell** who retired in 1967 as vice president and general counsel and a director of the Dow Chemical Co. wrote that he has opened a consulting office in Midland, Mich. He has two children, a boy and a girl. The boy went to Williams and then to M.I.T. for chemical engineering.

A recent acquisition of the Humanities Library Rare Book Room was a gift from **Samuel Glaser.** It was a copy of the *Nuremberg Chronical,* a world history nearly 500 years old published with movable type about 37 years after the Gutenberg Bible. The M.I.T. copy is one of about 30 in this country. . . . **Joe Terrell,** of Houston, Texas has retired as business office operation manager from Southwestern Bell Telephone Co. and is now enjoying life hunting and fishing.

I am sorry to have to report that the following members of our Class have recently passed on: **Charles E. Geisler** of Silver Spring, Md., December 3, 1970; **Luis Stefani** of Mayaguez, Puerto Rico, March 11, 1971; and **David J. Hillis** of Cambridge, Mass., April 2, 1971. Dave had retired as chief engineer at the Revere Sugar Refinery.—**E. Willard Gardiner** (Will), Secretary, 52 Foster St., Cambridge, Mass. 02138

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Here we are writing class notes three days before leaving for reunion but that's the way of the schedule. A couple of days ago on an errand to Gloucester your secretary, strictly by the laws of chance, spotted a distinguished looking couple walking into a store on Main St. Had they passed into the store we would have missed them and had there not been an errand we would not have been there. **Prince Warner** and his wife Ruth were in New England about ten days early for reunion. Prince is a trustee at Mt. Holyoke and a meeting brought him up so "why not tour New England again?" Naturally they came back to Pigeon Cove and in comparing notes about retirement it developed that Prince is my junior by exactly one month but due to Humble Oil's retirement formula he and I retired on the same day. Prince and Ruth continue to live in a town house in Houston but travel incessantly—mostly on deluxe freighters. Their experience with this mode of travel sounded most interesting.

We have just received a phone call from Edna and **Argo Landau** from St. Louis; they had scheduled their flight to Boston to attend reunion and were asking about transport to the Cape from Boston. Turned out they knew more about it than we since they plan to use a private airline we had never heard of.

Recently **Jim Killian** sent us a clipping from the *Peterborough* (N.H.) *Transcript* with an accompanying letter from which we quote: "You will note that among **Bud Wilbur**'s many activities are the moderatorship of Hancock and his assistantship to the president of Franklin Pierce College. The article

should have mentioned that he has written the words and music for what most of us like to think of as our Alma Mater." To quote from the newspaper article: "Two years ago this past Christmas Eleanor and Dick Amidon had a holiday dinner party at their home in Hancock. Among the guests were Dr. John 'Bud' Wilbur, Charles Robinson, and their wives. After dinner 'Bud' sat down at the Amidon piano for what he now remembers 'as a few numbers', and before the evening was over Charlie Robinson had returned home to fetch his horn, and host Amidon had dug out his clarinet. The combo was an instant success. A week later the threesome got together again, and what is now known as Hancock's 'celebrated' and inimitable, Jug Band was on its way.

"Bud plays piano by ear. In the tradition of a 'natural' musician, he cannot read music, and never had any lessons. As an undergraduate at M.I.T. he played the banjo and mandolin in Tech's Music Club."

A recent note from Warren Henderson, '33, (Thanks Warren) gives us the '26 attendees at the 1971 Mexico City M.I.T. Club Fiesta: James R. Killian, Jr. and Liz, Cambridge, Mass. and Fred and Margaret Dykstra, Detroit. . . . With three days to reunion, we say Cheerio until next month when we can start telling you about the reunion.—**George Warren Smith,** Secretary, P.O. Box 506, Pigeon Cove, Mass. 01966

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In connection with Homecoming activities at Cambridge, Dike Arnold is brewing up a special 1927 get-together. A room has been reserved, June 7, at the Algonquin Club for the 1927 dinner—classmates and spouses. Letters went out to likely candidates in the Boston area, and every effort will be made to find and corral any coming from out of town. The latter category already includes **Charlie Smith,** who lives in Cincinnati, and **Horace Emerson** of Westerly, R.I. Of course, among the topics to be discussed will be the reunion, just a year off.

Frank Marion Gorsuch died March 22 of this year. At Tech, he was in Course XV. During the forties, he lived in Baltimore and was an inspector for the War Assets Administration. In 1955, Frank moved to Owings Mills, Md., and joined the Logistics Division of the Aberdeen (Md.) Proving Ground; he became an advisor to the commanding general on maintenance of all types of army material. At the time of his death, his address was 9923 Reistertown Rd., Owings Mills, Md.

As a result of a grammatical error on my part and a correction by the *Review,* the May Notes seemed to say that **Cas Castellanos** and I were "among other" 1927ers at the Fiesta of the M.I.T. club of Mexico. Actually, there were just Cas and me. . . . I had a brief chat with **Bob Bonnar** last April. He was hard at work having lunch atop the Time and Life Building in New York.

Dr. E. H. Bramhall has moved from Phoenix to Sun City, Ariz.; Richard P. Innerasky Jr. from Harwich to Yarmouth Port, Mass.; Alden G. Reed from Palo Alto to Los Altos, Calif.; Russell W. Talbot from Philadelphia to Chicago; and David E. Truax from Lake Worth, Fla. to Charlotte, N.C. (May be moving north for the summer.) . . . In the notes of July 1946—25 years ago—I said I had seen a picture of **Sid Badger** and that he was not yet bald! This now seems an early date to be worrying about that. . . . Help! Need News!—**Joseph S. Harris,** Secretary, Box 654 Masons Island, Mystic, Conn. 06355

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We have had another letter from **Herm Jones** who is pleased that his Fair Exchange Policy ideas are being presented in these notes even if only briefly. The whole subject of foreign trade and related economic problems is so vast and complex that our few words can hardly be anything like an adequate treatment. Perhaps some of our economics-oriented classmates would like to correspond with Herm. Possibly something can be worked up of general interest for another department of the *Review.* . . . **Dud Collier** says that he is busier than ever now that he is "retired." He is active as a manufacturers' representative in various lines including architectural metals and illuminating supplies. His private interests center about gardening (flowers and vegetables) and in keeping his three-acre lot in trim.

Cnnic Susmeyan is now retired but working as a private consultant in his professional field—management services. This includes organizational problems, study of companies for acquisition, technical assistance in litigations, etc. Sus is still deeply interested in photography and especially enjoys portraits, figure work, and character studies. He is active in his camera club, does judging at contests, and has his own processing laboratory at home. . . . **Jim Donovan** called in with the following two items: Clara and **Arch Archibald** visited recently in Boston where their son has been active in theatrical work. Arch is designing a house which he is planning to have built this fall in Nova Scotia. . . . **Charles W. Newhall** is now semi-retired but working as a consultant. His present interest is in a practical solid waste handling system. It has had good acceptance and looks very promising.

Following are some miscellaneous brief contacts we have had, most of them were by telephone in a recent M.I.T. telethon session. Hopefully our mention here will spur these gentlemen to write us in more detail: **Jim St. Louis** expects to retire in about two years. **Des Shipley** was busy making crepe suzettes when he was called. He still travels a lot. **René Simard** plans to retire in November 1972. He and Pam are looking forward to the 45th. **Ralph Boeck** has retired but is teaching at Marquette University. **Harold Bialkowsky** is semi-retired. His wife died recently. He is planning to return to Washington State where he enjoyed living earlier. Harold has worked with a firm in Finland and has done much traveling. Early this year **Myron Helme** underwent a cataract operation. **Joe McQuillen,** at Grosse Pointe Farms, Mich. was cheerful on the telephone and appeared to be in good health. **Merrill Fenske** assured us that he is thoroughly enjoying his retirement.

With the arrival of warm weather there has been a sudden scarcity of correspondence from classmates. We hope this means that you are all busy traveling, enjoying the summer place, or just tending the flowers and shrubs.—**Walter J. Smith,** Secretary, 209 Waverly St., Arlington, Mass. 02174

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Paul V. Keyser, who recently retired from the Mobil Oil Corporation as executive vice president, and currently is president of the M.I.T. Alumni Association, has been elected to the board of directors of Witco Chemical Corp., during the company's 51st annual meeting held in New York City.

With sadness it is my duty to inform you that **Harold L. Halpert** of Arlington, Va., who attended our 40th reunion with his wife Ida, passed away on January 10, 1971. I have a letter from his widow as follows: "Dear Mr. Dinjian, It was so nice to hear from you. If you knew Harold during his undergraduate days, you must have known that he was not permitted to take R.O.T.C. because of his rheumatic heart. Harold was a patent examiner with the U.S. Patent Office from 1937 to his retirement in 1962 because of his heart condition. After retirement, he went into business for himself as a patent attorney and he induced me to become his secretary to become familiar with the type of work he did. Now I realize that he had a purpose in hiring me as his secretary. As a result of my experience I have been able to go into business for myself as 'Patent Secretarial Service', which makes me financially independent and not rely on our two married daughters who live near us.

"Harold had a pacemaker inserted in October 1969 but never worked properly due to the enlarged aortas. He had a second pacemaker operation in October 1970 which also did not work properly. He finally had open-heart surgery on December 10, 1970 from which he made a remarkable recovery. It worked beautifully but his heart just gave up on January 10, 1971. This was a case where the 'operation was a

success but the patient died.' Harold was a thoughtful and warmhearted person and life is difficult without him. Sincerely, Ida H. Halpert."

A brief note comes from **Robert S. Riley** of Middlebury, Conn., saying "Am officially retired as of May 1, 1971, but will work three days per week, except when I am on a pleasure trip." . . . I have a note from a relative of **Lee J. Schnackenberg** of Wakefield, Mass., whose death was reported in the last issue of the *Review*. "Lee died on March 8, 1971 in Mass. General Hospital from a fatal attack of hepatitis. He had been retired for the past three years from his post as secretary-treasurer of the Mass. Turnpike Authority from its inception. Prior to that, he was connected with Mass. Department of Public Works. His work with the Mass. Turnpike Authority was in financing, construction and the financial operation of the turnpike. He leaves his widow, Jean, as the only survivor."

Through the courtesy of Warren Henderson, '33, I have a memo listing those members of the Class of 1929 who attended the 1971 Mexico City M.I.T. Club Fiesta: John Russell Clark and Dorothy, Dallas, Texas; Salvador Madero and Esperanza, Mexico, Tlalpan, D.F.; Oscar Aros Villa, Mexico City; Leon Avalos Ves, and Carol, Mexico City.

Emanuel B. Hershberg of West Orange, N.J. was named vice president and scientific adviser to the Schering Corp., research division. Dr. Hershberg had been vice president, physical sciences. He joined the international pharmaceutical manufacturing company in 1945 and has served as manager of the sterol section and manager of chemical research and development. Dr. Hershberg was a research fellow at M.I.T. from 1933 to 1934 and at Harvard from 1935 to 1941; he was a chemist with the National Defense Research Committee from 1942 until he joined Schering. Schering Corporation established the E. B. Hershberg Predoctoral Fellowship in Organic Chemistry at M.I.T. in 1963 in recognition of Dr. Hershberg's contributions to the discovery and development of the corticosteroids prednisone and prednisolone. These drugs revolutionized the treatment of rheumatoid arthritis and allied collagen diseases as well as many allergic, dermatologic and ophthalmic conditions. Dr. Hershberg is a member of the American Chemical Society, Swiss Chemical Society, Society of Chemical Industry, American Pharmaceutical Association, and New York Academy of Sciences. He and his wife Charlotte have a daughter (Mrs. Abbott Weiss of Cambridge) and two sons, Elliott and Robert. . . . Have a pleasant summer.—**Karnig Dinjian,** Secretary, 32 Oldham Road, Arlington, Mass. 02174

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Your secretary would like to enter another plea to our retirees that they supply him with something more than the bald statement that they have retired. After all, retirement is a major turning point in most of our lives and, one would think, a time for reminiscing about past events that stand out in one's memory, some of which at least would undoubtedly be of interest to our classmates. Sometimes I am able to amplify these terse statements from the various source materials that I have available, but in the case of this month's retirees I drew a blank. . . . **William H.** ("Wanny") **Wannamaker** retired last year. He "traveled to Expo and on around world." . . . **Herm Botzow** has also retired, but does not say from what. The Botzows live in Hinckley, Ohio and have two sons. Herman Jr. received a B.S. from Princeton, an M.S. from M.I.T. and an M.B.A. from New York University. He works as a planning engineer for the New York Port Authority. Younger son William graduated from the College of the Ozarks and works as a C.P.A. for Eaton, Towne and Yale in Cleveland. Herm reports having recently seen **Ted Riehl** and **Jack Bennett. . . . George Brady** owns and operates the Brady Air Conditioning Company in Austin, Texas. The Bradys have a son George Jr., who is the General Tire distributor in Louisville, Ky., a grandson George, 3rd, who will enter the University of Kentucky next fall, and a granddaughter Linda. George's hobbies are quail hunting and raising pointers.

We have at hand a delayed report that **Charles Maskell** died a year ago February. Unfortunately no details are available other than that he was apparently living in Silver Spring, Md., at the time of his death.

Changes of address: Dr. Cecil G. Dunn, 3608 East Monte Vista Dr., Tucson, Ariz. 85716; Mr. Thomas M. Emery, 16933 Beechwood Rd., Birmingham, Mich. 48009; Mr. Arthur D. Roberts, 15 Prospect St., Apt. A-4, Norwalk, Conn. 06850;—**Gordon K. Lister,** Secretary, 530 Fifth Ave., New York, N.Y. 10036

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Unfortunately, the deadline for Class Notes for this issue is before our Class Reunion so I can't report on it at this time. However, from all reports, it should be a great success. As of this writing, there are over 108 registrants including wives and families and it is almost certain that the lodge and cottages at the Bald Peak Colony Club, which will accommodate 125 people, will be filled. Regretfully, yours truly could not attend the reunion because of his business trip to Japan and Australia.

Fred C. Eaton writes that he has returned from sunny Aruba to sunny Florida, where he has been living for six years and is now busier than ever—with church, Kiwanis, Mental Health, fishing, gardening and golf. He was not able to attend the reunion because he had to baby-sit with two grandsons in Peoria. . . . Congratulations to Dr. **Albert L. Kaye,** who won his advancement to full professor in the field of metallurgical engineering technology at Purdue University. Al turned to the teaching profession at Purdue after more than 30 years engineering experience in industry and as a business executive.

Following new addresses have been reported since the last Class Notes: Robert H. Baxter, 3500 Townsend Blvd., Jacksonville, Fla.; John L. Dodson, Rd. 2, Montpelier, Vt.; Donato A. Grieco, 47 Jewett Pkwy., Buffalo, N.Y.; Donald A. Holden, 201 Montvue Dr., Charlottesville, Va.; Robert M. Kelly, Tubman Road, Brewster, Mass.; Mrs. Harry A. Parris, 15 Mifflin Place, Cambridge, Mass.; James W. Perry, 4133 E. Pima, Tucson, Ariz.; Richard F. Wilder, 916 Breckinridge La., Louisville, Ky.

With sadness, I report the death of **Fred J. O'Sullivan,** on March 28, 1971. Our deepest sympathy to his family.—**Edwin S. Worden,** Secretary, 35 Minute Man Hill, Westport, Conn.

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Albert G. H. Dietz, Professor of Building Engineering, Department of Architecture, M.I.T. has been selected to receive the International Award in Plastics Science and Engineering given by the Society of Plastics Engineers. Professor Dietz is responsible for the execution of pioneering projects in the use of plastics in architecture including the Monsanto House in Disneyland and the U.S. Pavilion at the Brussel's World Fair He has authored four books on building materials and is author or co-author of 108 technical articles. He is a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science and the American Society of Civil Engineers and a member of many other professional societies.

Rolf Eliassen, Professor of Environmental Engineering, Stanford University has been elected to the National Academy of Engineering. Election to the Academy is the highest professional distinction that can be conferred on an American engineer. Professor Eliassen was honored for his leadership in education and research for the improvement of man and his environment. Of the 29 engineers elected to the Academy this year, five were M.I.T. graduates with the Class of '32 represented by Rolf.

Dr. Manson Benedict, head of the Department of Nuclear Engineering at M.I.T. joined other nuclear power experts including Professor Rolf Eliassen in speaking to the National Academy of Sciences on the lag in the American effort to produce nuclear substitutes for the present polluting methods of producing electric power. Neglected areas,

the experts told the Academy, are development of fusion power, fast-breeder nuclear reactors and direct conversion of fusion energy to electricity. Dr. Edward David, Jr., M.I.T., '47 President Nixon's science advisor, defended the government's role, but agreed that new options are needed if the nation is not to choke on the pollution caused by present power making, and with the use of electricity doubling every ten years the prospective amounts of three kinds of pollution—sulfur oxides, waste heat, and radioactivity are, by 1990 or 2000, quite frightening.

Donald Whiston has been appointed deputy director for Plant Systems Development in the Physical Plant Department of M.I.T. Don has been an associate director of the Physical Plant and will now direct a major review of the Institute's plant-related systems and procedures giving special concern to technological change, environmental considerations and cost effectiveness. In this process he will act as liaison with administrative and academic departments. . . . We seem to be closing this term with honors, awards and concern over pollution. We'll welcome your cards or letters over the summer to provide material for the fall issue.—**Elwood W. Schafer,** Class Secretary, M.I.T. Rm. 13-2145; **James Harper,** Assistant Secretary, 2700 So. Grant St., Arlington, Va.

33

We open this time with a press release from the University of Colorado telling us that one **Philip John Coffey,** has been awarded a master's degree in journalism. Philip's name does not appear on my cards, so it would be delightful were he to drop me a line explaining why. . . . Another release, from the Society of Women Engineers, tells us that, in 1968, a **Rodney D. Chipp** Memorial Award was established in his memory. We were not aware until now that this award existed, and, apparently, it was established by Rodney's widow, Dr. Beatrice A. Hicks, one of the founders of the Society, and its first president. Let us recall that Rodney was an internationally prominent engineer, who passed away in 1966, and the fact was reported in this column. Apparently, this award is not given annually, but only on occasions when the recipient is acknowledged to be outstanding and to merit the award. . . . We have a fine letter from **Beau Whitton,** in reply to one of mine. He allows that he might phone me from Orlando, where he has a regional office, come some winter. As of May first, spring had come to Charlotte, N.C. Glad to hear from you Beau, but, more news would be helpful.

This is our first opportunity to report on the annual Mexico City M.I.T. Club Fiesta. Without exact figures, it seemed as though there were 135-140 alumni in attendance, of which about 30 per cent were from the States. We were fortunate, in addition, to have with us Dr. Jim Killian, the honored guest of the event. We cannot emphasize too much the great time that this is, and has been. More and more of the fellows are taking in this good show as part of a more extended Mexican trip. . . . It now appears that **Norman Levinson,** is no longer Head of the Department of Mathematics at M.I.T. The reason seems to be that Norm has been made an "Institute Professor," a very much honored and distinguished rank. To recap a bit: Norm has been through all the steps leading to his present honored position, and has been recognized many times. In 1948 he was awarded the John Simon Guggenheim Fellowship, and spent a year at the University of Denmark. In 1953 he received the Bocher Memorial prize of the American Mathematical Society for his work on differential equations. More recently, he was awarded the 1971 Chauvenet Prize by the Mathematical Association of America. Norm is a member of not only the two societies mentioned above, but also the National Academy of Sciences, and is a Fellow of the American Academy of Arts and Sciences, and is a board member of the Weizman Institute. I did get this information from Norm, but, for him, the easy way. It all was printed in the M.I.T. publication, *Tech Talk.* Many thanks, Norm, we are proud of y'all.

From **Wilbur** (Bill) **Huston** we have a short, and quite personal note. Nothing much to quote because it was really not for publication. On my way north, I phoned Bill's home in Bowie, Md., but got no answer. In lieu of spending the eight cents, yeah, Bill, you may keep my version of the biography. . . . I was able to take in the last meeting of the Alumni Advisory Council at the Faculty Club in late April, and lo, not a regular classmate was there, except **Stan Walters,** who is not a regular. We did have a good meeting, and I had a good chance to fulfill my obligation by talking with many other classmen from our great alumni group. With my slightly impaired hearing, I find it worth the price of admission just to be able to talk with so many influential alumni, Alumni Association officers, and staff, and many just plain Joes. . . . I have a very short personal note from the old patriarch, **George Henning.** He pens out a full page of about forty words, but nary a bit of news. These fellas must think that I am writing fiction. Here's old George, with such a lovely Lucy, and he can't stir up any news. Even a word about the Liedercranz Club would have been acceptable.

From the Alumni Association we have two fine, loaded capsules this time around. From **Carl G. V. Swanson** comes word that he took a five-month vacation, last year. Not a word of what he did with the five months, though I suspect that he is saving that story for a rainy day. The vacation was a leave of absence and it turns out that it was a happy occasion when he returned to work. Carl commutes to work 42 miles every day, and he adds that he expects to move soon to the suburbs. I can't make out if 42 miles is too much or too little. As an aside, with retirement only three years away, what difference does it make? Well Carl says that he enjoys the class notes and I admit that he does contribute, but not in proportion. That's all fine, Carl, and I do so appreciate your info. Thanks a million. . . . The other capsule is from **Jack T. Turner,** not to be confused with the one and only Jim. Golly, he types in a real mouthful. Now hear this: Vice Chairman of the Barret and Turner Board (this is all business to here), then for pleasure: consultant, fiscal planning, Interfaith Housing Corp; Board Chairman, Fund Development Corp; Treasury Fund for Urban Negro Development; Chairman M.B.A./C.M.S. Mission, Advance Projects Committee; Chairman, Trustees Centre Congregational Church; Church and Mission Committee, United Church of Christ; Clerk, Metropolitan Boston Association; U.C.S., Liaison Committee; Fund to Boston Black United Front; Consultant, Roxbury Action Program. By Golly, is that all. I wonder what this fella does with the other hand! Seems like the Barret and Turner outfit believes in civic endeavor. Many thanks, Jack, even if I did have to resort to the capsule.

As I write, a week hence is the Homecoming Day for 1971. I expect to see about ten classmates, so wish now to say hello to the other 800 odd who will not show up, with a fervent wish that more of you will decide to reform, and join us next year. I expect that my tastes are average, and so do not hesitate to announce that this is really a happy, and enjoyable occasion, with an added feature this year: the reception for Dr. James Killian (Jim to you), who retires as of July first. We again look forward to the exceptional time at the Pops. Last year was a real rouser. I hope I see a bigger number of '33 men than usual. Leona and I will be on deck, as has been our wont for lo these many years, and we love it.

With no word on the 40th Gift Fund, I feel a bit constrained to make mention of the fact that we are going to put it over, and are surely depending on a lot of you fellas electing to pay the Institute back for the other half of the tuition that you did not pay while you were students. I am in no way a fund raiser, but this bit is about the only thing that some fellows get to read concerning the old Alma Mater.

Now, a short message to the faithful, who did not come through as well as usual this time. Remember, I do not make news; I can only report and I must have material on which to report. My only hope is to shame a few more of y'all into writing about yourselves for the benefit of all of us, and our own M.I.T.

We have a few address changes, to wit: George H. Bartlett, MG; Joseph E. Carbonall, Jr., AR (Joe now lives in a P.O. Box, sezzee); Herbert Grundman,

CE; Peter Parker, CM. These addresses are available to all of you, if the request is accompanied by a short family biography. Apparently this rider serves as a deterrent, as few of you ever ask for an address. That's it. We wish you all and sundry a good and pleasant summer, and always remember that Fort Rock is only seven miles from the N.H. Turnpike; 30 seconds by phone. Yours—**Warren J. Henderson,** Secretary, Fort Rock Farm, Exeter, N.H. 03837

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On May 19 a small group of our Class entertained M.I.T.'s new President, Dr. Jerome Wiesner, for cocktails and dinner and then remained after Dr. Wiesner left to discuss progress being made toward our Class 40th Reunion Gift. Present were Bill Abramowitz, Leo Beckwith, Ellis Flink, Howard Beck, Irving Banquer, Dick Jarrell, Max Wasserman, Bob Forster and Allan Mowatt. We were delighted to have the opportunity to talk with Dr. Wiesner on an informal basis and listen to his plans for M.I.T.'s future.

I made notes of everything except Wiesner's remarks: **Max Wasserman** is busy with two middle income housing projects: one in Cambridge of 275 units and one in Pittsfield of 250 units. . . . **Irving Banquer** and his wife had a wonderful six weeks in Portugal in January and February. . . . Betty and **Leo Beckwith** travelled to Japan with youngest daughter, Lola, to visit oldest daughter, Carol, who is living with a Japanese family while studying on her year-long scholarship from the Boston Museum. They were there for two and a half weeks and had a chance to play golf—lady caddies and all! . . . **Bill Abramowitz** advised that our Class has raised ¾ of a million dollars so far toward our $1¼ million goal for our 40th. Our $625,000 gift at our 25th Reunion is still the all-time high for 25th year class gifts.

Back on April 26 I mailed announcements of the 11th Annual Class Golf Tournament to nearly 50 of our Class. The first 16 acceptances who will play in the first Flight include: Ned Collins, Al Johnson, Gerry Rich, Sid Grazi, Bill Bates, Bob Forster, Allan Mowatt, Art Marquardt, Ham Dow, Dick Bailey (defending champion), Leo Beckwith, Ellis Flink, Sam Brown, Les Brooks, Bob Flood and John Brosnahan. My mass mailing produced a fine lot of replies from which I am excerpting below . . . **Charlie Ross** wrote "It's always nice to hear from you, but I'm a golf drop-out. Haven't played in two years." Mrs. **Paul** (Betty) **Daley** wrote for Paul: "I'm sorry to report that Paul is unable to enter the Class of 1935 Golf Tournament. He is incapacitated still due to a stroke a year ago—and probably will not be able to play again, though he loved the game." . . . **Ned Collins** was the first to send in his entry with this note: "I'm delighted to receive your April 26 letter regarding the Class Tournament and hereby serve notice that I intend to be the 'Silky Sullivan' in this year's race. My handicap is still 27 and if it changes, I will so notify you. Considering your efforts and your excellent letter, I hope you do get the 32 golfers." . . . **John Demo** sent his regrets: "Many thanks for sending details of the Class Golf Tournament, but I must decline because I can hardly furnish adequate competition. For some years now, I have pursued the white pill only a few rounds per season. I was never very sharp at the game anyway. Thanks also for the well-meaning plug you gave me in the February issue of *Technology Review.* My loosely knit consulting group is not intended as a bustling new career, but I do like to take on selected advisory assignments in the broad field of cosmetics and toiletries. As a fascinating sideline, I am developing some truly new personal care products. Regretfully, I have been single for too many years. With considerable help, I raised my one son since he was six and he now is practicing preventive dentistry in the Boston area. My very best to you. I am sure you have the appreciation of all thumb-sitting class members like myself for your worthy efforts in keeping the communication lines open."

Jack Orchard's card read: "You're doing a fine thing, except for old fogies with slipped discs and a torn knee ligament." . . . **Dick Bailey** sent in his entry with this note: "Please overlook my tardiness in replying to your letter. I have been away on business and it was lost in a pile of papers. I would be delighted to have you and your associate at our club. I see no reason why we couldn't get away for an afternoon of golf. It would be fun. I got away to the Masters again this year, which was enjoyable. We played at Persimmon Hill in the a.m. and went to Augusta in the p.m. My game suffered for a month while I was recovering from a rib bruise, but I think I'm back on the track now."

I had written Dick telling him of a projected business trip into Tennessee with my sales representative who flies his own plane and loves to play golf, too. . . . Warren Henderson, '33, sent along a note indicating that our Class was represented at the 1971 M.I.T. Mexico City Club Fiesta by **Hippolito Gerard** who makes his home there.

The Alumni Office has notified me of the death of **William M. Mahoney** on February 27. The last address I had for him was in Andover, so I called there and talked to his sister. Bill served in the navy during the war and afterward settled in Los Angeles where he married and had one daughter, who is now a sophomore at Pasadena State. He worked in an engineering capacity with the Los Angeles Power and Light until his death. His sister told me he loved golf and had a roomful of trophies.

Elmer J. Roth has been appointed Vice President—Finance by Loctite Corporation, the Newington, Conn. based manufacturer of adhesives and sealants. In this new position he will direct financial activities of the corporation and its subsidiaries throughout the world. Roth was formerly Vice President—Finance of Fafnir Bearing Company in New Britain, Conn. Prior to that he was controller of Stop and Shop, Inc., controller of Whitin Machine Works, operated his own management consulting firm and was supervisor of management services at Ernst and Ernst. Elmer and his family are residents of Simsbury, Conn.

Address changes received include: Colonel Louis (Bud) Pflanz, Jr., 242 Grant Ave., Eatontown, N.J. 07724; Edmund L. Gregor, West Brooksville, Me. 04617; William T. Barker, 4402 Mars Ct., Orlando, Fla. 32804. I had written to Bill on the Class Golf and hope to have more on his move from the Maine woods shortly. . . . I hope you are having a fine summer.—**Allan Q. Mowatt,** Secretary, 61 Beaumont Ave., Newtonville, Mass. 02160

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Since the deadline for these notes is just ahead of our reunion, news of that event will have to wait for the first fall issue. . . . I am happy to report that **Ollie Angevine** reads these notes and has pointed out that he cannot be found in Rochester as noted in the April *Review* but rather at 484 Main Street, East Aurora, N.Y. Ollie is among those listed as planning to attend the reunion as is **Larry Kanters.** Larry's note from Minneapolis is all superlatives—business (Gamble-Skogmo), skiing, sailing, etc. The Kanters young are scattered: son Jim in the Philippines; daughter, Sue in Israel; and the younger two off this fall. . . . **Larry Reday** reports that his firm, American Water Products Corp. is keeping him too busy to permit him to attend the reunion. It is a long way from Newport Beach to Massachusetts. Larry reports one daughter in Europe, one in Hollywood and a third about to go to the University of California.

Dr. **Clarence Cohn,** head of the nutritional science department at Michael Reese Hospital in Chicago died of a heart attack at his home in Winnetka on May first. I am indebted to a neighbor of the Class of 1951 for a clipping from the *Chicago Tribune* from which I quote: "Dr. Cohn, formerly head of Michael Reese Hospital's biochemistry department, was known in medical circles for his 'nibbling concept' of dieting. In studies on humans and animals he found that people gain less weight if they eat six small meals a day instead of two little ones and a big dinner. For his work he was honored by the Chicago Dietetic Association in 1969 with the organization's 'man of the year' award. He was also an associate professor of clinical pathology at the Chicago Medical School and a lecturer for the Council on Foods and Nutrition of the American Medical Association."

A. M. Clogston, '38

G. T. Rado, '39

N. L. Laschever, '40

Clarence was a widower and is survived by three daughters to whom the Class extends its sympathy.

I regret to have to report also two other deaths about which, I have no further information now. **Robert E. Sawyer** of Seattle died on October 11, 1970; and **Arthur K. Baker** of Chandler, Ariz. on February 4, 1971.—**Alice H. Kimball,** Secretary, 100 Memorial Dr., Apartment 8-6C, Cambridge, Mass. 02142 or P.O. Box 31, West Hartland, Conn. 06091

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Bert Bennison is moving to Talahassee, Fla. this June to become involved in public health and community medicine.

Win Johns has moved to 29 Yacht Club Dr., N. Palm Beach, Fla. 33408, and reports the weather is great down there. . . . **Fred Altman** is now senior scientist at Computer Sciences Corp., and is also chairman of the Space Communications Committee of Com. Tech Group of I.E.E.E. He was a delegate to the C.C.I.R. conferences in Nice in December and in Geneva in February. Fred's son and his wife are teaching in Paris on Fulbright scholarships while working on Ph.D. theses. His youngest daughter is first cellist in Northern Virginia Youth Symphony with trips to Florida and Switzerland. His oldest daughter is a nurse at Duke University's Hospital.

Martin M. Kuban after nine years with the Screw Corporation of America, Ampeo Metal Division has changed jobs and is now a project engineer with Logemann Brothers Co.

Our Class was represented at the 1971 Mexico City Club Fiesta by **Bill Bergen** and his wife Eleanor, **A. W. Chandler** and his wife Louise and **Wells Coleman** and his wife Mabel. Looks like they had a small 1937 reunion in preparation for our thirty-fifth in June 1972.—**Robert H. Thorson,** Secretary, 506 Riverside Ave., Medford, Mass. 02155; **Curtiss Powell,** Assistant Secretary, Rm. 5-325 M.I.T., Cambridge, Mass. 02142; **Jerome Salney,** Assistant Secretary, Egbert Hill, Morristown, N.J.

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Senor Warren Henderson, secretary of the class of 1933 was good enough to inform me that Charlotte and **Bob Bowie** and Dorann and **Dempsey Christenson** attended the 1971 Mexico City Fiesta. Incidentally, I have been fortunate enough to be there several times and if you have the opportunity of attending some year, it is well worth your while. . . . **Pearl Lichtenstein** writes: "After a number of years in research on upper atmospheric phenomena (aurora, mostly) I was a casualty of the cut-back in federal grants. I am now teaching physics full time at the new local community college." . . . **John A. Petroskas** writes us the following note: "The Petroskas still live in Swarthmore. Jim is the only one in high school. Betsy is a microbiologist, John Jr. is teaching, Suzie is still in Purdue. We have three grandchildren, so time roars on. I am still in metallurgy and I have the problem from the conception to the resurrection. I am now chief metallurgist, Phoenix Steel, Phoenixville." . . . Major General **Willard Roper** is presently chairman of the Board of Engineers for Rivers and Harbors, Washington, D.C. . . . **N. H. Wheless, Jr.,** has been president of Mid-Continental Oil and Gas Association since 1970.

Donald S. Macdonald wrote a letter to Don Severance which Don sent to me for publication. It reads as follows: "If I could be on hand for this year's reunion, I certainly would like nothing better than the Pops. However, my older son is graduating from Duke this year, and that takes priority. Incidentally, I am about to change occupations again, this time to college teaching. I have a Fulbright grant beginning in September, to go to Korea in order to work on a doctoral dissertation. When I get back from that, I'll take up an appointment to the faculty of East Stroudsburg State College, which is in the Poconos resort area near the Delaware Water Gap. In the meantime, I'm working on the dissertation, doing consulting work for Operations Research Inc., and also consulting for the State Department from time to time. Jeanie is about to get her M.A. in education, and plans to go into elementary education because that seems to be as good a place as any to translate social concern into practice."

Last, but not least, a news release from Murray Hill, N.J.: **Albert M. Clogston** has been named vice president for research in the Sandia Corporation in Albuquerque, New Mexico. The Sandia Corporation is a subsidiary of the Western Electric Company. Dr. Clogston had been director of the Physical Research Laboratory at Bell Laboratories in Murray Hill, N.J. since 1965.—**A. L. Bruneau, Jr.,** Secretary, Hurdman and Cranstoun, Penney and Co., 140 Broadway, New York, N.Y. 10005

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Dr. **George T. Rado,** a renowned scientist at the Naval Research Laboratory in Washington, received the Navy Award for Distinguished Achievement in Science, for his pioneering achievements in experimental and theoretical magnetism research. George, who continued on after graduation to earn his doctorate from the Institute in '43, also received a gold medal, an emblem, and a check for $5000! He is head of the Magnetism Branch, Solid State Division, N.R.L., and his research has directly resulted in valuable technological developments of magnetic materials used in microwave and communications devices the world over.

The *Gourmet Magazine* for April, 1971, carried a delightful article on **Dick Cella**'s famous New York restaurant, Christ Cella, at 160 East 46th Street. Descriptions of Cella's menus made for hungry recollections of fine meals there! . . . **William A. Smith** of Public Service Electric and Gas Company, Newark, N.J., recently earned a promotion to substation and service engineer. He is a member of Public Service's Communications Task Force and of the electrical system and equipment committee of the Edison Electric Institute. . . . **Paul E. Sandorff,** Senior Research and Development Engineer of Lockheed-California Company, Burbank, Calif., contributed as co-author of a paper "Slip Front Mechanisms in Mechanical Joints" at the A.I.A.A./A.S.M.E. Structures, Struc-

I. M. Pei, '40, and friend, as they appeared in a recent Newsweek *article on architecture and man. (Photo: Robert R. McElroy,* Newsweek*)*

tural Dynamics, and Materials Conference, in April. . . . **David A. Bartlett,** of Tulsa, and Beatrice and **Irving Peskos,** of Homestead, Fla., were the '39 representatives at the 1971 Mexico City M.I.T. Club Fiesta.

John J. Casey, who began with '39 and graduated with '40, wrote that he reads with interest the alumni notes for both classes. He is now executive vice president, sales and operations, Braniff International, in Dallas. . . . John expressed appreciation particularly for the notes in the May '71 issue concerning **Robert Van Nice** who studied the Mosque of St. Sophia in Istanbul for thirty years. He raised questions which I of course couldn't answer, and so I sent Xerox copies of the original source material to both John and Van.

Charles S. Mercer forwarded a *New York Times* clipping dated May 1 carrying the death notice of **Harlow Reed,** vice president and chief operations officer of Olin Corporation. Chuck had sailed with Harlow frequently on his ocean racer, Blackjack, and had kept in close touch with him over the years. Surviving are his widow Jacqueline Smyth Reed, and three daughters. Our condolences to them all.—**Oswald Stewart,** Secretary, 3395 Green Meadow Circle, Bethlehem, Pa. 18017

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From **Wes Pendleton** comes the note that he has been appointed chairman of the Technical Program Committee of the electrical and electronic division to be held in Chicago September 20-23, 1971. In addition to being hard work, this is quite an honor. The conference which occurs every two years, is attended by 4,000 I.E.E.E. members. Ralph Nader is one of the featured speakers and Wes remarks: "Nader is a strange bedfellow for me but he will attract attention. I have been a member of I.E.E.E. for 36 years (1935) and a Fellow for eight years." . . . Through the Alumni Association, this Secretary learned of the death of **John Fee** on March 1, 1971. John was in Course XIII-A. . . . **Norm Laschever** is now chief engineer at R.C.A. Aerospace Systems Division. . . . **Lester Lees** who is professor of aeronautics and environmental health at California Institute of Technology has been elected to the National Academy of Engineering for pioneering work in the field of supersonic and hypersonic flow phenomena. . . . **Arnie Arch,** who for many years was executive secretary of the Air Pollution Control Association, is now air pollution manager for Westinghouse's environmental quality department. . . . **Bill Woodward** records his dissent to the article on Teller in the March *Tech Review:* "That was a lousy article on Teller. No wonder the author made it anonymous." (*For more on this, see* Technology Review *for May 1971, Correspondence Review, p. 82.*)

John Strickland notes: "In 1970 (February) I was laid off by Boeing. Since then I have been employed by a consulting engineering firm as airport programs manager—also I am presently a self-employed consulting engineer." . . . While from **Ed Di Giannantonio** there is the following: "Joined Edo Corp., College Point, N.Y., as marketing manager for A.S.W. Systems of the Government Products Group. Involved in marketing new and improved surface ship and submarine sonar systems to the U.S. Navy." . . . **Ted Thomas** notes: "Just a line to let you know I'm still functioning as a die-hard New Englander and Bell Systems employee. Golf, skiing, and family take up my time in that order. That's what my pretty wife, Maria, tells me! I've been a department chief at Western Electric Co., No. Andover, Mass. so long that they have tried me out at most everything. I've supervised plant construction activities, factory engineering and maintenance, various manufacturing shops, and design engineers and have done so with fun and my usual enthusiasm." Isa and **William Green** and Bernie and **George Kosco** attended the Mexico City 1971 Club Fiesta.

I. M. Pei is one of the architects featured in the April 19, 1971 issue of *Newsweek.* In developing "Superblock" in the Bedford-Stuyvesant section of Brooklyn, New York, I. M. Pei and partners closed off a street to traffic and filled it with trees, playgrounds and fountains. These were conceived by the architects but modified by people on the block, working with Pei's planners. "Instead of the rich clients we usually deal with," says a Pei spokesman, "we were listening to the people, who, like it or not, were going to live there. We were groping all the way, because it was wholly new to us, but we've carried our experience onto other jobs." . . . Unless the gremlins get into the column again, please note your secretary's new address.—**Alvin Guttag,** Cushman, Darby & Cushman, 1801 K Street, N.W., Washington, D.C. 20006

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George Hite and **Earl Krohn,** president and treasurer respectively of Krohn-Hite Corporation, 580 Massachusetts Ave., Cambridge, Mass., provide a fine example of two classmates with talent and innovative product ideas teaming up to form, from small beginnings, a successful business enterprise which last year had sales in excess of $2,000,000. Their present product line includes high quality electronic filters, oscillators, amplifiers, function generators and alternating current power sources. The company's 1971 catalogue is an impressive 78-page affair which includes not only specifications and descriptive details on the company products, but also an educational dissertation covering history and design theory involved which should prove to be very helpful to anyone interested in using these products. By way of background for this enterprise, both George and Earl, after graduating from M.I.T. in 1941, spent five years as employees at the Radiation Laboratory at M.I.T., followed by four years each at the Naval Research Laboratory on Atlantic Ave. in Boston. During this period, in their spare time, they developed and built their first commercial product, an ultra low frequency oscillator with an operating range of .02 to 20 kHz. With this product they in 1949 launched their company from a 250 square foot rented room on the second floor of the same building in which the company's 90 employees now occupy in excess of 20,000 square feet.

George says that the company was successful from the start with gross sales in its first year of operation being about $50,000 and a profit being shown

for every year since then, including 1970. However, so far in 1971 it has been necessary to reduce company size from 130 employees to the present 90 due to the current business recession. Nevertheless the company continues to maintain a strong internal research and development department of 15 employees of which five are senior engineers whose function is that of continually improving company product lines to keep ahead of the competition. George finds that in this industry a new product whether patented or not has an average useful competitive life to the company of about five years. That is why at Krohn-Hite about 10 per cent of revenues are devoted to internal research and development. Conversion of circuits from thermionic tube to solid state and miniaturization have been important goals for all company product lines, goals which George proudly states will soon have been achieved. The company's sales are primarily through factory representatives of which there are 12 covering the United States and 19 covering the major nations of the world. About 60 per cent of sales are to customers in the United States and about 40 per cent to customers in foreign countries. George has a son who has just finished his first year at Boston University Law School, and a daughter who has just completed her third year at New York University where she is majoring in library science, the vocation of her mother. Earl is a proud grandfather in that his daughter is married and has two children.

Albert H. Bowker has been named chancellor of the University of California at Berkeley which has 28,000 students and is one of nine campuses of the University of California. He will assume his new post in late summer and says that he is "mildly optimistic" about the prospects for peace on the Berkeley campus next year. He has for the past eight years been chancellor at City University in New York where he presided over 20 campuses with a total of 195,000 students, and a budget of $328,000,000. His salary at City University was $46,900 a year; at Berkeley it was be $47,000. . . . **Jacob Berezow** is currently working as a physicist at the U.S. Naval Ordnance Laboratory, Silver Spring, Md. In connection with his work there he is co-author of the publications "Bottom Impact and Penetration of the Subroc Depth Bomb" and "Captor Case Motion Study" and is presently working on "An Experimental Investigation on Methods to Suppress the Flutter Motion of Elastically Suspended Cylinders Exposed to Uniform Cross-Flow."

Donald D. Scarff, vice president in charge of consumer products at General Electric Company has announced that G.E. is entering the entertainment business and has created a subsidiary, Tomorrow Productions, Inc. for the purpose of going into closed circuit distribution of sports and other attractions to theatres and cable TV systems. Donald found himself in show business after climbing the G.E. executive ladder through the company's lamp division in Cleveland. He started with G.E. in engineering, later moved into sales and promotion and was elected a vice president in 1964 when he was general manager of the lamp division.—**Walter J. Kreske,** Secretary, 53 State St., Boston, Mass. 02109; **Everett R. Ackerson,** Assistant Secretary, 831 Cranford Ave., Westfield, N.J.; **Michael Driscoll,** Assistant Secretary, 63 Center St., Nantucket, Mass.

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Jack Sheetz, Vice President of Tufts, was one of the participants at the New England District Conference of the A.C.P.R.A. (American College Public Relations Association). Begin to wonder whether specialized associations are out-running the supply of specialty expertise, or vice versa? . . . Captain **Donald H. Kern** is Commander of Portsmouth Naval Shipyard, and apparently has been in this post since March 1969, without any nod from this column, thought we'd better get it on the record, before he transfers out. . . . **Cart Laffoon** is now senior vice president of San Diego Gas and Electric and is responsible for plants, plant sites, fuel and conceptual planning of all gas and electric resources. . . . **Donn Barber** heads up planning activities for Polyolefins Division of du Pont's Plastics Department and writes that he had a coffee break with **Charlie Speas** who was visiting the head-shed of du Pont in Wilmington a little while ago. . . . **Jon Noyes** has again visited the great M.I.T. Club of Mexico Fiesta in Mexico City and heartily recommends it to one and all. . . . **F. R. Meyer, 3rd,** has been elected to the Board of Directors of the *Peoria* (Illinois) *Journal Star.* In addition to his work as a business consultant, Dick is president of the Y.M.C.A. in Oak Park, a trustee of George Williams College in Downers Grove, past president of the Junior Association of Commerce of Chicago, and past president of the River Forest Board of Education.

A very comprehensive and interesting article appearing in *Mechanical Engineering* on ball bearings was written by **Bill Benhard** of the Charles Stark Draper Laboratory. . . . A most interesting letter by **Charlie Smith** appears in the May issue of *Nation's Business.* Charlie is chairman of the board of Steel Improvement and Forge Company in Cleveland and took occasion to disagree with *Nation's Business* article on George Shultz. The quotation by Mr. Shultz was ". . . bad decisions in the private sector bring their own penalties—a greedy management prices itself out of the market, a greedy union prices itself out of jobs." Charlie's dissent pointed out that a greedy union does not price itself out of jobs until after it has destroyed the enterprise (management, shareholders and fellow employees) that had been providing the jobs, a cogent thought, to be sure.

The Killian Concert at Carnegie Hall was a wonderful performance and those enjoying it, whom Jean and I saw, were Francine and **Jim Stern,** Rhoda and **Alan Katzenstein, Adrian Marcuse, Charlie Speas, Bob Kraus** and **Floyd Lyon.**

Just received an announcement from ye pres, **Jerry Coe,** that **Harvey Kram** has accepted the chairmanship of our 30th Reunion. It is scheduled for the weekend of June 3 and 4, 1972. You'll be hearing more about it from Harvey but it is not too early to save the date!

Our very sincerest condolences to

R. H. Battin, '45

Elliot Friedman whose son Warren, an applicant to the Freshman Class of September 1971, died suddenly in February. Elliott is now director of engineering at Bruno/New York Corporation and we wish him the best of success there. . . . Our sympathy is extended to the family of Dr. **Harrison Lavender** who received an Sc.D. in chemical engineering with our Class and to the family of **Guido Verrochi** who got his S.B. in civil engineering in Course XI. . . . Best wishes for a fine summer.—**Ken Rosett,** Secretary, 191 Albemarle Rd., White Plains, N.Y. 10605

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With this issue we draw to a close our 26th year as Institute graduates. Unfortunately, the year has been empty if interest, information or activity were the only measure of fulfillment. This past year with the deaths of **Bob Hildebrand, Ross Compton** and **Mark Haines** presents a void in not only the class but more importantly in the families and communities of the deceased. As much as we may hate to admit, we are at that age where both death and a dearth of correspondence play a larger part in our lives. The latter we can control! Let us collectively vow to keep one another better informed in this coming year.

H. Paul Grant (it is now Howard P.!) advises that life is frantic! Three kids in college with five to go. Paul has suggested we check with him again in 1983 and he will advise how it all turned out! . . . Our local *Stamford Advocate* in mid-February had an article about Greg Bowen, Tufts top pole vaulter. As you might suspect proud parents **Al Bowen** and Billie missed the article completely (and I'm just forwarding it to them 3½ months later!). . . . Warren J. Henderson, '33, advises that **Hector Orozco** and Luz Maria of Mexico City represented the class at the 1971 Mexico Club Fiesta. . . . **Richard H. Battin,** Associate Director of the Draper Lab has been named conference chairman of I.E.E.E.'s fifth annual computer conference to be held at the Sheraton-Boston Hotel this September. Most of you are aware, I believe, that Dick was named an A.I.A.A. Fellow last year.

William Linvill of Stanford University spoke on "Technology and the Needs of Man" at a Brown University Colloquial Series in January. . . . The Al Bowens, Jim Levitans, Chris Bolands and Clint Springers represented the Class at the Fairfield County Club's tribute to Howard Johnson in early March. Chris, Jean, Fran and I caught the first M.I.T. Center musical tribute to the Killians while Tom and Louise McNamara joined Fran and I for the second tribute in Carnegie Hall in late April. Goodness knows who attended the May finale! And finale is the perfect word to use in drawing this year to a close. See you all in the fall.—**C. H. Springer,** Secretary, MFB Mutual Insurance Company, 420 Lexington Avenue, New York, N. Y. 10017

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The mail from you fellow classmates has dwindled to nearly zero. Please excuse the short column, but keep in mind that we can only write when the members of the class write us. Please send off a short note to us on your activities now.

We received a nice note from **Morton Goldfarb,** Course VII. Mort is one of our many medical doctors and suggested it is time for a Medical Doctors Reunion —Class 1946. Mort lives in Massapequa, N. Y., and is practicing urology in the Long Island area. He is director of urology at Nassau Medical Center, and chief at the Brunswick Medical Center. The Goldfarbs have four children. During the years Mort has seen four other Class 1946 doctors, Roger Hickler, Jim Bennett, Fred Gray and Ed Welch. . . . **Gifford H. Stanton**'s new address is 310 65th St., New York City. He remains in management consulting work from a marketing point of view. Last year he was appointed manager at Drake, Sheahan, Stewart Dougall. Gifford reports he has two guest cottages in Bermuda which he rents to friends. If anyone is interested now or in the future, contact him at his New York City address.

Ned Tebbetts has recently been elected group actuary at New England Mutual Life Insurance Company. Ned joined this company in 1954, previously spending several years on the actuarial staff of John Hancock. After graduating from M.I.T., Ned obtained his master's degree at the University of Michigan. Ned, his wife, Priscilla, and three sons, John, Richard and Charles, live in Cohasset. Besides being chairman of our own 25th Class Reunion, Ned is a Fellow of the Society of Actuaries and a member of the Boston Actuaries Club.

Seymour Collins, Course II, completed a course in advanced management at Harvard University Graduate School of Management. Seymour of Campbell, Calif., is president of Westfab Mfg. Co. of Fremont, Calif.—**Russ Dostal,** Secretary, 18837 Palm Circle, Cleveland, Ohio 44126

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This is a beautiful spring weekend and no time to be indoors. This coupled with a dearth of news will make these notes even briefer then usual. You all received **Arnold Judson**'s letter requesting desires for our 25th. Trust that you all will answer promptly as plans must be made. When answering why not put in a comment or two as to what you have been doing and I know that Arnold will pass them on to me for these notes.

I was very sorry to hear of the death of **Fred Sylvander** in March but have no details.

Ruth Mileson writes that she has now worked a year at her first job with the N.U.S. Corporation in Rockville, Md. She is taking oceanography courses and looking for an "opportunity" as a beachcomber. . . . **Joe Deal** just graduated from the Advanced Management Program at the Harvard Business School. Joe is director of the Market Development Division of Newport News Shipbuilding and Dry Dock in Newport News, Va. . . . Since there is no other news will get to work in the yard then practice Colt League pitching with son Bob. May have time for some golf but after yesterday's 36 holes; think I should limit myself to the practice tee.—**Dick O'Donnell,** Secretary, 28516 Lincoln Rd., Bay Village, Ohio 44140

Do you recognize this hard-working '48er in the sandwich board? If not, see page 47, this issue, for a report on the activities of his company, the Boston Computer Group. (Photo: Fred Wheeler)

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Bill Zimmerman, who was Class Secretary from 1948 until 1958, is living in Los Angeles. Bill is one of our classmates who helped develop the camaraderie and communication links that enable our Class to have a high degree of common purpose and spirit. Bill is president of Swedlow Manufacturing, a company that manufactures and fabricates acrylic windows used for cockpits and passenger compartments on commercial and military aircraft. Changes in the airframe industry have made Bill's job extremely challenging, but under Bill's management Swedlow is moving forward despite the industry problems. Prior to joining Swedlow, Bill was president of Avery Products, a manufacturer of adhesive-based products. Avery's record of growth during Bill's leadership was from $12 to $89 million in annual sales. Bill and his wife and their children live in Pasadena. Bill is on the board of directors of a number of Los Angeles businesses and other organizations. During our visit, Bill and I shared recollections of life at M.I.T. in school and in the dorms on East Campus. **Ken Brock** had visited Bill. John Weil and Jules Levin have not been heard from very recently. Bill has helped M.I.T. in several ways in recent years, adding to his many contributions as an undergraduate and class officer.

Jesse H. Haines is with General Electric. His recent note was brief, but he reminded the M.I.T. Alumni Fund to collect a matching gift from G. E. . . . Sonny Monosson, our class president, has tried everything in the book to get a treasurer's report from our treasurer, **Verity Smith.** If any classmates have an idea on how to *convince* Verity, please write to Sonny, or better still, *convince* Verity. . . . **George R. Cooper, Jr.,** informs us of his appointment last year as deputy director, Insurance Claims, Overseas Private Investment Corporation. O.P.I.C. is a newly established agency of the U.S. Government which handles private investment loan guarantee and political risk insurance programs. . . . Word has been received of the activities of Antonio de Almeida. After a year at M.I.T., Tony went on to pursue a career as an orchestra conductor, and is now in this country to begin preparation for a series of four concerts with the Houston Symphony. . . . **Stanley Shein** recently sent along his company newsletter; he is president of Management Techniques, Inc. of Newton, Mass. This company specializes in programming effective computer systems for a variety of businesses. . . . Speaking of computers, **Sonny Monosson's** company, The Boston Computer Group has just published a report "All About Used Computers." For more information on this report and the activities of the Boston Computer Group see page 47, this issue.

By way of Ken Brock, we hear that **Charles A. Licht** has remarried, and has become the "instant father" of six teen-age kids. He, wife Dolores, and family are now living at 68 Graymoor Lane, Olympia Fields, Ill. Three years ago, Chuck left U.S. Reduction where he had served as vice president, to form Charles Licht Engineering Associates, Inc. His company offers management and engineering consulting services, largely in the fields of metallurgical and chemical industries. Many of these companies are involved in the secondary processing of iron, aluminum, nickel, etc. and their alloys. To quote from Chuck's letter, "We were probably a little ahead of our time in this great concept of 'recycling of materials.' "—**S. Martin Billett,** Secretary, 16 Greenwood Ave., Barrington, R. I. 02806

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We have two deaths to report this month. **J. Bernard Quigley,** N.E.E. alumnus of M.I.T., who was also an alumnus of the U.S. Naval Academy and Harvard Law School, died on December 29, 1970. At the time of his death, he was a member of the law firm of Cahill, Gordon, Sonnett, Reindel and Ohl of New York City. He is survived by his widow and two daughters, to whom go our deepest sympathy. . . . We also have information that **Fred M. Newton** of Jacksonville, Fla., died on January 30, 1971. We have no other information at this time.

From the Alumni Fund envelopes come happier items. **David Israel** confirmed the information which I reported last month on his current position as director of the Office of Systems Engineering Management for the Federal Aviation Administration. . . . **David V. Stallard** reports that he is receiving his Sc.D. from M.I.T. in June, 1971, with his doctoral work generously supported by his employer, the Missile Systems Division of Raytheon. He lives in Wayland with his wife and three lively sons. . . . **Edward Somma** reports that he is finally back in the business that he knows best, since October 1970, when he purchased Grodel, Inc., a small screw machine products company of $2 million sales and 45 employees. Since 1963, when he had sold the family company (also screw machines) he had sold insurance for four years and then bought a mill supply company.

Gaetano Falabella, Jr., of Bedford, Mass., Deputy Director, Airdrop Engineering Laboratory, U.S. Army Natick Laboratories, is one of 46 executives from industry, government and the medical health services, to be selected as 1971-72 Alfred P. Sloan Fellows at the Sloan School of Management. . . . **William Haddon, Jr.,** President, Insurance Institute for Highway Safety, in Washington, D.C., was chairman of a panel discussion, "The Developing Role of the Ambulance Attendant" at the National Symposium on Medical Care in Philadelphia in early May.

By the time you read this, M.I.T. Homecoming will have come and gone. I hope to have seen many of you there. Best wishes—**Frank T. Hulswit,** Secretary, 77 Temple Road, Concord, Mass. 01742

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The reunion has come and gone—since these notes were written in April, I can only speculate that based on the large number of early reservations, it was another record setter. Now we can all look forward to an equally successful 25th! This issue marks the end of Volume 73 and the final issue has always been my opportunity to excerpt from several of the letters that I have received and, at the same time report on some

of our classmates who have been in the news so extensively that they really deserve a column all their own. So it is with **David Ragone.** I don't even know where to begin and the longer I hold out, the more the news accumulates. David left Carnegie-Mellon University last summer to take over as Dean of the Thayer School of Engineering at Dartmouth (his predecessor had left to become Assistant Secretary of Commerce for Science and Technology in Washington). For a metallurgist, Dave has really diversified: he has been active in the field of automotive fuels, air pollution and electric cars; he was head judge in the Clean Air Car Race of 1970 (M.I.T. to Cal Tech); headed a panel for the U.S. Commerce Department on lead in gasoline; is a director of Steam Engine Systems, Inc. of Newton, Mass. (a company trying to produce a 100-horsepower non-polluting vehicle several generations removed from the Stanley Steamer); he is a member of President Nixon's council on environmental quality and serves or heads various related panels. He was recently elected to the Board of Trustees at both Dartmouth and Mitre Corp. Of all of this and the accompanying accolades David says, "I've been having all kinds of fun."

Another one who is hard to keep up with is **Sandy Sussman.** As he wrote, just when we catch up with him he is off to something else. Sandy found a new job which met his requirements: less than ten miles from his home. He is executive assistant to the group vice president, semiconductor products group, of General Instrument Corp., Hicksville, Long Island. They are among the top manufacturers of M.O.S. devices. (What are they? If I knew I wouldn't have abbreviated it!) Sandy says that it was lucky that this came along when it did—he was having trouble meeting his golf and country club fees.

Peter Preston is in Savannah, Ga. at American Cyanamid's large titanium dioxide plant. Peter is still in R. and D. but now as a group leader in engineering development. He, Jane and the two children enjoy their skiing and have traveled to Europe twice in the last five years to see and ski Austria/Germany. Other hobbies include woodworking and swimming, and I can't figure out where he gets the time because he has also just received his M.S. in chemical engineering from the University of Virginia. Finally he reports that he has heard from the **Bill Diffin**s (Belhaney, Okla.) and the **Toni Tabaks.** As you read last month, Toni lead the way to beautifying the Duquesne Incline, Pittsburgh, as a one-man conservation team. Thanks Pete for thinking of us. . . . **Ken Kruger,** Architect, won an award of merit from the New Jersey Society of Architects for his design of the Lounsberry Hollow School in Vernon, N.J. Ken works out of the Boston office of Kruger, Kruger, Albenberg, Hurley. Other offices are in Newark and San Francisco. . . . The **Herb Graham**s have set a terrific example for other classmates: they send your secretary a copy of their Christmas newsletter. Those of you who send such a letter annually ought to send one more copy—to us your class secretaries—I'll even pay the postage! The Grahams visited Haiti and Jamaica this past year and were impressed by the extremes. "First impressions were extreme poverty, but lush vegetation; crowded streets but clear skies; old buses that average 15 miles per hour, Hondas on twisting country roads; and DC-3's that count chickens, turkeys and goats amongst the passenger list." Herb has always been active in church work, and there they witnessed Christian baptism by day and voodoo drums at night. I would delight in going on—it is exciting to hear from those of you who have followed avocations, interesting hobbies, and sometimes just living at a pace that says "the hell with the pressures, I'll do my own thing the best I can." I'd get poetic but my job is to report, not to editorialize. Herb, Ruth, Colette, David and Kathy are now all back in California. Herb is with T.R.W. and working on a transportation program for the state of California.

"Once he helped design weapons, now he runs a church" reads the headline on a story of Reverend **Randall Gibson,** minister of the Charles Street Meeting House. After his degree in electrical engineering and a stint with the M.I.T. Instrumentation Lab, Randall obtained a degree from the Harvard Divinity School. His church and interests are quite diverse but reflect his concern for people. He is anti-Viet Nam war but not anti-war (he served as a corpsman in WWII). He is the divorced father of four children but feels that the church tends to abandon divorced people. He has strived to open his church to people with people-problems ranging from divorce to unwanted pregnancies to drugs to other community problems. In his own words: "We don't condemn anybody here, that's not our right."

Two of your retiring secretaries have made the newspapers recently: **Mickey Alper** is the new head of the Jet Propulsion Laboratory's Civil Systems Project Office and acting manager of the group's Transportation Technology Office. Mickey has been with J.P.L. for over fifteen years. His family never sees him, either. . . . **Walter Davis** rejoined the executive staff of Warren Brothers Co. after twelve years in the asphalt and crushed stone business. Walt and Madeline live in Brockton, Mass. as you know. Their oldest daughter, Janine, is a student at Catholic University in Washington, D.C. while Laurene and Walter (Chip) are in the local high school.

I guess that I've filled up enough space now; this marks the end of my seven year tenure as your class secretary. After having never missed a column in 63 consecutive issues I'm sure that you realize that it is with mixed emotions that I take leave of you in this capacity. But I now look forward to serving you further as your new class president and to strive to keep '51 a leader. My gratitude to all of you who wrote and encouraged us. Special thanks to those who shared these duties with me: Walt, Paul and Mickey (and Forest Monkman from my prior term) for, and it can't be said any differently, "without whose help none of this. . . ." To someone that none of you knew: Gail (Mrs. Phillip) Pendergast, (Simmons '65) my secretary, who squeezed in the Class Notes amongst her daily duties, took our rough copy, half-typed, half-handwritten and made them legible and sensible. And to someone many of you do know, my wife Ellie, who helped sort, sympathize and support our efforts to keep you informed. And to all the nice people in the *Review*

office: Thank you. All of you.—Ciao— **Howard L. Levingston,** Secretary, 358 Emerson Rd., Lexington, Mass. 02173; Assistant Secretaries: **Walter O. Davis,** 346 Forest Ave., Brockton, Mass. 02402; **Paul Smith,** 11 Old Farm Rd., N. Caldwell, N.J. 07006; **Marshall Alper,** 1130 Coronet Ave. Pasadena, Calif. 91107

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Two letters have arrived since the last column. One from **Charles A. Honigsberg** notes that he has moved from New York City to the Pittsburgh area, 4175 Ivanhoe Dr., Monroeville, Pa. 15146. Charlie is working at the Advanced Reactors Division of the Westinghouse Electric Corporation. . . . The other from **Richard F. Lacey** enclosed a clipping from the *San Francisco Chronicle* describing the arrest of Charles Schwartz, professor of physics at the University of California, Berkeley, during an anti-war protest demonstration. Dick also remarked that riding a bicycle to work is not always as healthy as your secretary previously indicated. Dick and his bicycle were hit by a pickup truck driven by a Japanese gardener on El Camino Real—result: one broken collarbone.

A couple of news items. **Tony Ralston** is now chairman of the Department of Computer Science at the State University of New York at Buffalo where, until recently, he had also been director of computer services. . . . **Joe Alibrandi,** executive vice president of the Whittaker Corp. has been elected president and chief operating officer. He will also serve as chairman of the corporation's executive committee. . . . **Richard Daly** writes that he is now manager of a Signal Processing Section at Raytheon's Wayland Laboratory. He, his wife, and six children live in Framingham, Mass.

Chief Forecaster for the Bing Crosby Golf Clambake at Pebble Beach during January was **Glyndon L. Lynde.** Glyndon earns his living as an operations analyst at Litton Systems, Inc., Fort Ord, Calif. . . . **Darrel A. Frohrib** is now director of Design Center, University of Minnesota, doing research in mechanism systems and regional development modeling. His present studies relate to an irrigation system in Rajasthan, India. He plans to present a paper "Optimization of Flexural Strain Energy" at the World Mechanism Conference in Yugoslavia in September 1971.

Many of our classmates are involved in the anti-pollution battle. Professor **Roger R. Borden,** Worcester Polytechnic Institute, was faculty advisor for the winning teams from W.P.I. in the M.I.T.-Cal Tech Clean Air Car Race. The entries were the W.P.I. Propane Gasser and Electric Hybrid. . . . **Robert G. Shaver** of General Technologies Corporation, Reston, Va., has published "Study of Cost of Sulphur Oxide and Particulate Control Using Solvent Refined Coal." . . . **Wayne D. Mount,** Head of the Atmospheric Physics Section at the Sperry Rand Research Center, Sudbury, Mass. has written a paper "Air Pollution and Human Survival" describing the THERMASONDE, an atmospheric temperature sounding device developed by Sperry Rand.

The press releases this month are numerous. **John J. Magarian** has been named president of Bowmar Canada, Ltd., Ottawa, Ontario. John was vice president and director of U.S. operations for Transitron prior to joining Bowmar. . . . **John R. Myer** has been promoted to Professor of Architecture at M.I.T., effective July 1, 1971. . . . **Nathan Sivin,** Associate Professor of the History of Science at M.I.T. has received a fellowship for 1971 from the John Simon Guggenheim Memorial Foundation. . . . **Frank T. Wheby** has been appointed head of the Underground Projects Division, Harza Engineering Co., Chicago. Frank has worked on many underground engineering projects including the Deep Tunnel Plan of the Metropolitan Sanitary District of Greater Chicago. . . . **Francis C. Hyson,** C.F.A. has been appointed research director and member of the investment committee of Arthur Wiesenberger and Co., Inc., investment managers. Francis, his wife and two daughters reside in Cos Cob, Conn.— **Arthur S. Turner,** Secretary, 175 Lowell Street, Carlisle, Mass. 01741

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Perhaps the most important issue to be settled in the coming months for the Class of '53 is that of the site for the reunion two years from now in June 1973. J. Burlove, who has recently been appointed to the Advisory Council of the Small Business Administration in Syracuse, New York, has cast his vote in favor of a reunion in Bermuda or the Bahamas for 1973. He also has offered his services to help make arrangements. In view of the longer distance and higher travel expense which a Bahama reunion would entail for most members of the class, compared with a reunion in Bermuda, it would seem logical to consider Bermuda as the preferred choice, if indeed a reunion outside of the New England area is preferred by the majority of the Class. In any event, we certainly welcome comments and suggestions concerning where the reunion should be held. At the moment, the majority of correspondence commenting on the Bermuda possibility has been positive, and so we will probably be pursuing this course of action unless other suggestions are received by the end of this summer. Our reunion planning must become serious before the year is out, especially if a Bermuda location is to be selected.

With the building trades becoming active again in New England after a tough winter, it is appropriate to mention that **Robert P. McDonald,** who has been with the Vappi and Company construction company, was president of the Massachusetts Building Congress during the 1970 calendar year. As you may recall, Bob finds enough time to be quite proficient in golf, as some of the recent golf outings during our reunion meetings testify. . . . Regarding another form of construction, we have just received a note that **Dave Berg** is the designer of the New England Patriots football stadium, now under construction in Foxboro, Mass. Dave's efficient design work apparently was partially responsible for the realization of this stadium, which had been discussed and considered for several years. . . . We commented earlier about **Bill Gouse, Jr.,** having been appointed as technical assistant to Dr. Lee Dubridge and Dr. Edward David of the Office of Science and Technology, on President Nixon's staff. We are happy to report that Bill Gouse has now returned to the academic profession and has recently been appointed Associate Dean of Carnegie Institute of Technology in the School of Urban and Public Affairs. Bill was on leave of absence for about a year while serving in Washington with the O.S.T.

Concerning classmates who are embarking on new careers or who are in unusual locations, **Robert Colton** is now spending a year at Birmingham University in England on a fellowship sponsored by the Secretary of the Army. . . . **Charles Downing** has recently passed the California Bar Examination and is now a practicing attorney in that state. . . . **Allan Hoffman** is now a professor of bioengineering at the University of Washington in Seattle. He and his family enjoy the West Coast after having spent most of the past two decades at M.I.T. and in the Boston area . . . **A. E. J. Gallagher** is now working for a subsidiary of Arthur G. McKee & Co. in Melbourne, Australia, in connection with activities in the minerals field. . . . **James P. Johnston** is now on the faculty of Stanford in the Mechanical Engineering Department, after having spent some time as a visiting research scientist at the Aerodynamics Division of the National Physical Laboratory in Great Britain. . . . And speaking of Stanford, **Bob Piper** has recently obtained a Ph.D. from the Business School at Stanford. He tells me that one principal reason for selecting Stanford for his doctoral program was that the percentage of attractive girls at that particular location was perhaps higher than any other, either in this country or abroad. Knowing Bob, I am sure he could substantiate this opinion.

And with the coming of spring you would be interested in knowing that **Olgierd Pruszanowski** has become engaged to Miss Angeline Hansen. It may be significant that Olgierd is not currently employed, "because of other interests."

Other Californians reporting are **Vince Verlangieri** who received his master's degree in business economics from Claremont graduate school a year ago. Vince has been working with General Dynamics in Pomona, Calif., for about 15 years. . . . **H. J. Myers** reports that he

and his family are still in California where he is senior programmer for I.B.M. in the field of languages. . . . Back on the home front, **Jerome Connor, Jr.,** has been appointed to M.I.T.'s Civil Engineering Department as full professor . . . and **Joseph Rodriguez,** who is a special assistant to the vice president of Aerospace Corp. recently finished a Sloan School program.

Some of the new addresses of classmates who are in various parts of the country are as follows: **Dan Lippman** is now in Phoenix, Ariz. (366 E. Verde Lane). . . . **Jesse Erickson** is now in Oakland, Calif., with Kaiser Aluminum at 300 Lakeside Dr. . . . **John Hansen** is now in Greensboro, N.C. (5502 Guida Dr.) . . . Dr. **Jon VanWinkle** is now in Pittsfield, Mass., not too far away from where his great-great-great-great grandfather reportedly fell asleep. . . . **Bruce Martin** is now in Charlottesville, Va. (1721 Yorktowne Dr.) . . . **Robert Donohue** is now in Long Beach, Calif. . . . **Kaye Richey** is now located in the Panama Canal Zone, Box 278, Balboa Heights.

John Ballantine, Jr., is now in Santa Barbara, Calif., at 1138 North Patterson Ave. . . . **George Fuld,** one of our brighter food technologists in the Class of 1953 is now located in Baltimore, Md. (P.O. Box 5745). . . . **Russell Kidder,** who has been with Stauffer Chemical Company for a number of years, now lists his home address as R.F.D. #1 Church Hill Rd., West Redding, Conn.

Over the next few months, a program for the 1973 reunion will be taking shape, and we will plan to keep you abreast of the developments. In the meanwhile, we very much would welcome your ideas and suggestions as to where the reunion location should be, especially if you believe that a location other than Bermuda would be preferable.—**M. C. Manderson** (Mandy), Secretary, Longly Road, Groton, Mass. 01450

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This is the time of year to load the wife, kids, and a lot of unnecessary fabric and hardware into the station wagon, and to drive 800 miles to discover the darker side of your personality and the relative merits of home.

Mario P. de Figueiredo has been appointed vice president, research and development, of Hollywood Brands, a division of Consolidated Foods Corp. Mario was a manager of quality assurance and technological research for The Kitchens of Sara Lee, a subsidiary of Consolidated Foods. He is a Fellow of the American Institute of Chemists, of the American Public Health Association, and of the British Institute of Food Service. Mario, who is a native of Goa, the former Portuguese community in India, was presented with the Outstanding New Citizen of the Year award by the Citizenship Council of Chicago in 1970. . . . **Larry Berman** finished the Boston Marathon again this year, as he has so often before. You may have seen author Eric Segal on TV, predicting that he would be outpaced by Larry's wife Sara Mae. Sure enough, he was. . . . **Tony Merz** has received his Ph.D. in aero/astro from Stanford University. He remarks that his timing was not too good, and he hadn't found a permanent position at the time he wrote. His thesis title is intriguing: "The Homicidal Chauffeur—A Differential Game." Tony and his wife have two children and hope to settle in the Bay area.

Judith and **Lennard Wharton** joyfully announce the birth of a son on April 24. He is named Nathaniel Albert, after both grandfathers. Lenny is a professor at the University of Chicago. . . . **Frederic Morgenthaler** and family have picked up and moved out of the happy little high tax haven of Winchester and moved to Wellesley, Mass. He claims I made too much noise, but I suspect other motives.

An earlier column concerning large families has brought a response from **Larry Begetta.** Larry and his wife Ova have thirteen children, and he writes that they do not regret one bit their move to a farm directly after graduation. According to Larry the work is hard, but the living is pure. . . . If you have any news to share with your classmates, please send it to—**Allan C. Schell,** Secretary, 19 Wedgemere Ave., Winchester, Mass. 01890

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The first news about reunion '72 has arrived in a letter from **Mal Jones:** "Reunion plans are just beginning to hum. There's really no single chairman. Jim Cunningham, Garry Dischell and I are working together right now. Perhaps in the fall Jim will take over as chairman. We're thinking about a different reunion for the 15th. Maybe a charter flight starting in Boston, stopping in New York, Philadelphia, and Washington and then on to somewhere in the Caribbean for three days—Friday, Saturday and Sunday. But this is not definite. We need to know what people want to do and how much they're willing to spend." For those who have ideas, questions, or offers of help, Mal can be reached at M.I.T. or at home, 214 Fullon Road in Lexington.

Dick Douglass (see picture on this page) has been appointed vice president and general manager for Improved Laminated Metals Company of Providence. Previously Dick was director of marketing and engineering and before that director of technical services for the company. Dick holds his master's degree in metallurgy from Ohio State University. Improved Laminated Metals, a subsidiary of International Metals and Machines, Inc., manufactures precious metal laminates in wire, tubing, sheet and strip form for the electronics and jewelry industry.

Richard W. Douglass, '57

Ralph Warburton writes that he recently returned from a trip to Iran and the Soviet Union, advising the government of the former country on urban development matters. Earlier in the year he served on the national design award juries of the Consulting Engineers Council, the American Society of Landscape Architects, and the U.S. Department of Housing and Urban Development. . . . **Dick Baird** sends the shock announcement of the year: "Hard to believe, but my son, Richard, will be a member of the Class of 1975 this fall."—That's all for now. Have a good summer.—**Frederick L. Morefield,** Secretary, Tiirasaarentie 17, 00200 Helsinki 20, Finland

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Al Philippe is vice president of the Metal Fabrication Plant of Harford Metal Products, Inc., for which he has worked since receiving his S.M. in '61. Al has been busy in small town America as a member of the Aberdeen, Md., Planning and Zoning Commission, past president of the Aberdeen Rotary Club, and president of a building and loan association. Apparently all these activities leave Al no time for rowing, but **Pete Peterson** keeps his oar in by serving on the Rowing Games Planning Committee for the Munich Olympiad to be held in 1972. As many of you know, Pete is one of the founders and a vice president of Softech, Inc., which is a software engineering firm specializing in custom software development and in providing users with systems to construct their own software packages. Pete, Marilyn, and their three children are living in Acton, Mass.

Edward Goldman is president and a founder of Technology Associates, Inc., which specializes in transfer of technology, legal-technical consulting, and product diversification and licensing of technical developments. As a sideline, though, the firm is marketing the Spoky—bright plastic tubes for attaching to bicycle wheel spokes. So, let your kids buy Spokies for their bikes and give Ed's new enterprise a boost. . . . **Thomas Blood** is now teaching a final-

year design course at McGill University, in addition to his work in his own architectural firm in Montreal. . . . **Kenneth Smith** has been promoted to Professor of Chemical Engineering at M.I.T. and **John Deyst** to Associate Professor in Aeronautics and Astronautics. . . . **Mike Greenberg** has been appointed chief engineer of Modicon Corporation in Bedford, Mass. Prior to this post Mike was a product engineer and before that a staff engineer with Bedford Associates, Inc., where he was engaged in electronic system design. . . . **Walter Braun** is now attending graduate school at American University and working toward a Ph.D. in physics.

While on a flight from New York to Boston I ran into Pieter Nimno who is working at the Draper Lab on interactive graphics systems and other minicomputer-based systems. . . . Last month, when I had despaired of receiving news and just missed an issue of the *Review*, this note from **Vic Klemas** arrived: "I don't like to write if I can avoid it, but I thought I should let you know that after nine years with General Electric I have decided to leave my slick business friends behind and enter pure academic life. I just joined the University of Delaware as associate professor at the College of Marine Studies in Newark, Del. In addition to teaching and research, I will be coordinating several remote sensing activities in Delaware Bay. Despite start-up frustrations, I am already enjoying my new life quite a lot. You and **Toni Schuman** are doing a fine job keeping us informed of our classmates' conquests. Keep it up!" (How sweet it is!)—**Michael E. Brose,** Secretary, 199 Sudbury Rd., Concord, Mass.; **Antonia D. Schuman,** 22400 Napa St., Canoga Park, Calif.

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To date, the busiest member of the Class of '62 appears to be **Vic Schneider.** Seemingly a very prolific worker, Vic proudly announces his promotion to the position of Associate Professor of Computer Sciences at Purdue. Recent proof of the fruits of additional labor was evidenced by the happy birth of fraternal twin sons, Jesse Michael and Jerold Philip, born to Vic and his wife, Lea, on January 3, 1971. . . . Selected for the James B. MacElwane Award was **Carl I. Wunsch** of the Department of Earth and Planetary Sciences at M.I.T. Dr. Wunsch was honored at a special luncheon on April 13, during the 52nd Annual Meeting of the A.G.U., which was attended by over 2,500 of the world's scientists.

We have word from **Arthur D. Snider** that he is the Assistant Professor of Mathematics at the University of South Florida. . . . while **Carl Andrysiak** is senior engineer at Corning Glass Works, where he is doing research and development of glass-forming processes . . . at M.I.T., also on the rise is **Stephen K. Burns,** who has been promoted to Associate Professor of Electrical Engineering . . . and **John W. Devanney, 3rd,** will be assuming the position of Associate Professor of Naval Architecture and Marine Engineering.—**Gerald L. Katell,** Secretary, 122 North Maple Drive, Beverly Hills, Calif. 90210

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My thanks to Fran (Mrs. **Bud**) **Risser** for her letter. She and Bud are living in St. Petersburg, Fla. from where they report the birth of their first child. They were all about to embark on a two-week jaunt to Colorado in their Piper Cherokee. Bud is with the Risser Oil Corp., a Texaco jobber in the area. . . . **David Johnson** is now with the Aladdin Synergetics Div. of Aladdin Industries in Nashville, Tenn., where he is involved in the management of industrial development. They provide food service systems for hospitals, schools, and airlines. Dave attended the recent Alumni Seminar on Engineering Opportunities in the Health Care Industry and we had time to chat. . . . **Mike Lifschitz** is a medical resident at University Hospital, San Francisco County. . . . **Stan Diamond** is at the Smithsonian Astrophysical Observatory in Cambridge. I saw Stan recently and after a few handshakes he said to me, "You are a terrible class secretary." I in turn asked if he would like to do the column some month. There was no reply. . . . **R. Brian Strong** is selling data processing equipment for I.B.M. in Miami. He has one son, Robbie and is expecting another child. Sailing in the Bahamas is a current spare-time filler. . . . **Ronald Young** completed his Ph.D. in Course XVI and is now with S. Ross and Company in Boston. . . . **Elliot Koffman** reports a wife Caryn as well as three children. He is now an assistant professor at the University of Connecticut. . . . **Jim Ruttenberg** is at I.B.M. in Armonk, N.Y. working in the field of planning and management of telecommunications networks. Jim reports a first child Sherrie Renee.

Fulbright

Terry Foster writes that he is involved in the management of the systems engineering department at Henninson, Durham, and Richardson, Inc. in Omaha, a consulting engineering firm. He was making plans for a four-month trip to Yugoslavia for earthquake research under a Fulbright-Hays Grant.

Lawyers

Thomas Sheriff is practicing law in Tulsa. He and his wife, Silvia have a son Andy and a daughter Nora. . . . **Jerrold Miller** received his M.S.E.E. from the University of Wisconsin in 1964 and is presently attending American University Law School at night. He is married to the former Betty Jane Goldberg of Baltimore. They have a daughter and are expecting a second child. . . . **Robert Morse** received his master's in electrical engineering from Tech and a law degree from Harvard. He is now with the patent law firm of Kenyon and Kenyon in New York City. He is married to the former Sandra Goldstein a graduate of Simmons and they have a daughter Lisa Jennifer.

New Arrivals

New son, a first for Janet and **Walter Dence.** . . . A second child, Andrew, for **Mal Beaverstock.** . . . Lucy and **Rich Silver** had a baby girl, Sarah. . . . **Bill Wolf** reports the birth of Ann Stockwell Wolf. Bill is with I.B.M. and asks what are the rest of the Sigma Nus doing?

Peace Corps Philosopher

Donald Dreisbach spent two years after graduation in graduate school and then entered the Peace Corps. His tour was

spent teaching English at a university in Iran. Returning to graduate school he received one of the few *real* doctorates of philosophy, in philosophy, from Northwestern. His wife is the former Frances Jefferies and he is presently an assistant professor in the philosophy department at Northern Michigan University in Marquette.

Architects, Managers and more
William Zoller received his New York State Architectural License in 1968 after working for William B. Tabler, Architect for almost five years. He then traveled in Europe for a few months and ended up working for an American consulting firm in Brussels. His wife, the former Janice Day, and he have two children Johnny and Beth. . . . **Thomas Nelson** is an Assistant Professor of Business Administration at the University of Iowa, and announces the birth of a son Mark.

Stephen Evans is working at Rocketdyne and has been accepted for the Engineering Executive Program at U.C.L.A. . . . **Herbert Doepken** is at High Voltage Engineering and will soon complete his master's in management at Northeastern. . . . Yes, there are more. **Tony Dralle** received a Ph.D. in physics from Carnegie-Mellon and is now working for Westinghouse Electric on neutron cross-section measurements. He is married to the former Wendy Sommers of Washington, D.C. They have a son. . . . **Andy Campbell** writes, "I finally) received my Ph.D. from Princeton and am teaching at the University of California at San Diego. The math department is a good place to work, and I am enjoying myself, but I dream of going overseas for a few years."

Medicine
Warren Sewall finished two years in the army and is now a resident in radiation therapy at Massachusetts General Hospital in Boston. . . . **Alan Marty** writes, "After three years at Peter Bent Brigham Hospital in Boston, I am completing my surgical training at the University of California Hospital in San Diego, with hopes of continuing a career in surgical research and practice." . . . **John Flaherty** is completing a three-year tour of duty in the U.S. Public Health Service at the National Institutes of Health. He will be returning to Johns Hopkins Hospital to complete his clinical training in cardiology. He reports his third son Keith.

Industry
Stephen Bram is with ConEdison and involved with engineering management in the Generator Planning Division. He has been living in New Jersey for the last couple of years with his wife Connie and two sons Jeff and Neal. . . . **Frank Verlot** is involved in program management at the United Technology Center of United Aircraft. He was looking forward to a European trip. . . . **Tobias Zidle** is in Houston with Pan American Petroleum Corp. and is working on a geophysical exploration project. He has a new addition to the family, Melissa, born in June of 1970. . . . **Tony Geisler** is in product management at Mallinckrodt Chemical Works. His wife has given up teaching and is a secretary at W. R. Grace. They are expecting a child. . . . **Stephen McClure** is working as a management consultant at Honeywell Information Systems. He and his wife Donna and daughter Heather live in Auburndale, Mass. . . . **John Brach** is involved in the supervision of construction of one Washington subway project and the design of another. He and his wife Donna bought a house in which their 14-month-old son Brian is reported to be showing tendency toward engineering.

Research
Ted Packard received his Ph.D. in biochemistry from the University of Washington and is now an oceanographer in the ocean department there. He is married and has two children Dana and Lucius. . . . **Floyd Stecker** is working in theoretical high energy astrophysics at the Goddard Space Flight Center. He just completed a soon-to-be-published book on Gamma rays. He reports a second son, Jonathan. . . . **Anthony Fiory** is involved in semiconductor research at Bell Telephone Labs, Murray Hills, N.J. He is married to the former Jean O'Leary of Ithaca, N.Y. . . . **Edward Dudewicz** attended the annual meeting of the Institute of Mathematical Statistics where he was chairman of a session on Selection Procedures and presented a paper on Ranked Means.—**Martin Schrage,** Secretary, 305 Massachusetts Ave., Arlington, Mass. 02174

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Two Class Heroes came through this month with news. One is **Jon Orloff,** who reports that he is working for Elektros, Inc. in Tigard, Ore., a manufacturer of scientific instruments. He and his wife raise dogs for a hobby. The other Class Hero is **Peter Cooperberg,** who just returned to Canada from a year in Israel with his wife Jeannie and their nine-month-old daughter. In Israel Peter was a resident in radiology for six months and then a general practitioner on a kibbutz near the Lebanese border. This month Peter and his family will move to Vancouver where he will continue his residency in radiology.

News from alumni clippings reveals that **Barry Hancock** is studying Spanish in Costa Rica to prepare himself for missionary service in Peru. . . . **Alan E. E. Rogers** was among a group of M.I.T. graduates cited by the American Academy of Arts and Sciences for their work in the field of long-baseline interferometry.

And that, classmates, is all the news I have. Please write and have a happy summer.—**Ron Gilman,** Secretary, 5209 Peg Lane, Memphis, Tenn. 38117

65

It appears that all of my complaining has had an effect as the last month was marked by a spate of letters, notes and visits. Keep it up! **Bill Brody** sent a nice letter with news about himself and some classmates. Bill received his M.D. from Stanford in June of 1970 and spent the last year as a postdoctoral fellow in cardiovascular surgery and finishing up a Ph.D. in electrical engineering. His thesis is on ultrasonic blood flow measurement devices. He has also been working on experimental techniques for coronary artery surgery and heart transplantation. Bill will be an intern in surgery (the army willing) at Stanford by the time you read this. Bill also sent some notes about other classmates.

Wayne Haase is working on his Ph.D. at the Stanford integrated circuits laboratory. **Warren Anderson** received his M.D. from Stanford last June and has been interning in San Francisco. . . . **Mike Huke** and his wife Sandy are living in Washington, D.C. . . . **Frank Yin** has completed his Ph.D. at the University of California at San Diego and is now a first-year medical student there along with his wife Elaine. Bill says that Stanford is swarming with M.I.T. alumni but most are from other classes.

Ed Hoffer was also nice enough to send a letter about his activities. Ed is finishing his assistant residency at Massachusetts General Hospital and will be there for one more year as a Fellow before returning to Canada. Ed and his wife Pamela recently became the proud parents of an adopted son, Jonathan Edward, and are now adjusted to 4 a.m. feedings. Ed says their dog has gotten over his initial jealousy and is now quite blasé about Jonathan. . . . Ed reports that **Bruce Fauman** is joining the faculty of the University of British Columbia Business School and that **Mike Long** is a resident in anesthesiology at Mass. General. Ed also says that Linda and **Jim Steele** are living up in Maine and are the parents of at least two (that should be down Maine, Ed.) . . . I have received from the Alumni Association news of a number of classmates' educational achievements. **Ron Newbower, Jim Sprinkle,** and **Leonardo Peusner** all received Ph.D.'s in March from Harvard. . . . **Martin Breidenbach** is a research associate at M.I.T.'s Laboratory for Nuclear Science. Martin received his Ph.D. in physics from M.I.T. in June 1970 and has just been awarded an N.S.F. postdoctoral fellowship. He will use the fellowship for research at C.E.R.N. in Geneva.

The program for the 1971 conference on Advances in Computing at Stony Brook, New York sponsored by the Association for Computing Machinery includes a talk by **Pat Winston.** Pat will talk on "Eyes for Robots" and on the capabilities of the M.I.T. robot. Pat is an Assistant Professor of Electrical Engineering at M.I.T. and is affiliated with the new Artificial Intelligence Laboratory. . . . **Gilbert Falk** was married to the former Ronnye Coren on August 25, 1968. Gil completed his Ph.D. at Stanford last summer and is now on the computer science faculty at Rutgers. . . . **Walter Miller** is an intern in pediatrics at Mass. General. He was married last February to the former Gail Forrest Barber in Winston-Salem, N.C. Gail is a nurse at Mass. General. . . . **Jim Larsen** and his wife Dee report the birth of their second child, Dana Britt. Jim and Dee now have a boy and a girl.

Phil Hardin is in Washington, D.C. working at the Naval Ship Engineering Center on submarine design. Phil finished his Ph.D. in mechanical engineering at M.I.T. last fall with a thesis in computer science. Then his navy R.O.T.C. caught up with him. Phil and his wife Jane have been skiing in Pennsylvania and Vermont and building furniture in their spare time. . . . **Mike Foster** is an Assistant Professor of Aeronautical and Astronautical Engineering at the Ohio State University in Columbus. . . . **Robert Reichelt** is working in the Headquarters Employee Relations Department of Humble Oil and Refining Company in Houston as the Corporate Equal Employment Opportunity Advisor. . . . **John Forbis** is a second-year student at the Harvard Business School. . . . **Ed Burke** was in Boston a few weeks ago and we had a nice visit. Ed is finishing a doctorate in electrical engineering at the University of Pennsylvania and has been working part-time for Burroughs in Paoli, Pa. He and his wife are enthusiastic skiiers. . . . **Jim Pepe** is finishing a doctorate in mathematics at M.I.T. with a thesis topic that sounds as much like psychology as math. Jim and Judy live in Arlington, and Judy is finishing up her nursing degree at Boston University. Judy is thinking about graduate work in nursing or medicine and Jim will join a small computer company in Cambridge this summer. . . . Brenda and **Matt Mleziva** were in town recently. Matt is a captain in the air force, stationed at Wright-Patterson A.F.B. in Dayton, Ohio. Matt expects to leave the service in August and hopes to return to the Boston area.

Bill Brody's letter closed with a couple of questions. The first concerned **Dick Tsien:** Is it true that he's at Yale?—I think so, but don't know for sure. The second was about me: What are you doing these days?—I am a member of the technical staff of the Mitre Corp. in Bedford, Mass. I work in the Command and Management Systems Department and am concerned with security for computer systems and software for communications processors. My work has ranged from looking at basic technology to the engineering of solutions to user problems, mainly for Air Force commands. In my spare time, I get outside for hiking and ski touring and try to stay single, or to avoid staying single depending on my mood of the moment.—**Steve Lipner,** Secretary, 940 Belmont St., Watertown, Mass. 02172

66

As I begin my last column, my thoughts drift back over the last two years and all the fun writing these words has been for me. I hope the next Class Secretary will enjoy it as much as I have.

My first report should be about the other classmates in the Fort Collins area. Mary and **Tom Jones** have just bought a new house and will move in the next week or so. Tom is in the electrical engineering department at Colorado State University. Mary taught one course in the English department last term here too. . . . **Tom Gomersal** finishes up real soon at C.S.U. in statistics and is planning to go to work for an insurance company "if they agree to my terms," among which is allowing him (or paying him) to pursue another degree.

Terry May has consistently kept us abreast of his wanderings and has the following info. He recently received the Bronze Star in Viet Nam while serving as a survey officer with headquarters battery, I Field Force Viet Nam Artillery near Nha Trang. He also holds the Army Commendation Medal. . . . **Art Boyars** finished a master's in electrical engineering and is now back at the Naval Ordnance Lab.

The Ph.D. mill continues to grind. **Charles Boley** received his in February from M.I.T. in physics. . . . **Stu Shapiro** was awarded one in computer sciences at

Wisconsin in January. . . . **Dennis Sivers** obtained a Ph.D. in high energy physics theory from Cal Berkeley in 1970 and is now working as a postdoc at the Argonne National Lab. . . . Still at M.I.T. is **Bob Pindyck** who was promoted from a teaching assistant in the department of economics to an assistant professor in the A.P. Sloan School of Management effective July first. . . . **Chester Balestra** has recently joined the Research Labs of Eastman Kodak. He received his Ph.D. from M.I.T. in materials science. He and Patricia have one son, Scott Anthony. . . . **Dennis Guthrie** is a software programmer for the Air Force Logistics Command. Last July, he and Susan Ford were married. . . . **John Freeman** now works for an overseas private investment firm in Washington, D.C. and is developing real estate on the side. . . . **Bert Barrington** (who most of us remember as Bert Blewett) graduated from the University of Michigan Medical School and will go to the Mayo Clinic in ophthalmology. He has "one wife, one son, twenty-three creditors." How did you manage so few, Bert?

For my last act as Class Secretary, let me make honorary Heroes-of-the-Month all those classmates and others who contributed news for these columns for the past two years. Each has played his part in making this a rewarding experience for me and hopefully an enjoyable column for you. Cheers!—**Terry J. Vander Werff,** 2049 Manchester Dr., Fort Collins, Colo. 80521

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"Darkness, Darkness," the first major film of **David Espar**'s film company, was shown by N.B.C. on May 4, 1971, as part of *First Tuesday.* The film is a color documentary about heroin addiction among white, middle-class kids in Palo Alto. It is done in a verite/interview style—the junkies tell their own story with no interference from so-called "experts." Veriation Films completed the film last October. Segments were shown nationally on "The Advocates" in March and the entire 37-minute film was on K.Q.E.D., San Francisco, in February. A 20-minute version was cut specifically for *First Tuesday.* "Darkness, Darkness" has been quite well received as an educational film. It is being used by schools throughout the country and has received good reviews in several health and educational publications. It is presently in the finals of the American Film Festival in New York.

It is about time that I brought you up to date on the activities of Edie and **Chuck Hottinger.** I have visited them frequently since September; it's pretty easy to mooch a lot of good food and wine off them. Chuck and Edie (Oates), B.U. '69, were married May 24, 1969. Katie Marie arrived December 8, 1970, and has since established herself as the star and master of the household, the household being a nice jungle apartment at Stanford University where Chuck is working on his Ph.D. in electrical engineering. Katie takes care of Chuck when Edie works on weekends. They recently came to Stanford from Livermore, northern California's answer to Burbank, where Chuck worked for Sandia. . . . Loree and **Ken Ogan** traveled north from unsteady southern California to visit them for a weekend a few weeks ago. It was good to see them again. Ken is studying for a Ph.D. in chemistry and Loree is working on a master's in home economics. Ken and Loree are planning a trip to Oslo, Norway, in August where Ken will attend a conference.

Alan Hayes is working on a Ph.D. in computer science at the University of Utah; he expects to finish this fall. He writes that Salt Lake City is full of Mormons who don't have a "proper appreciation of booze and who attempt to impose their views about this and other matters on the whole state." He reports that the state has nice places for backpacking and the country's best skiing. . . . **David Leary** hopes to finish his Ph.D. work at Berkeley by December. His wife Cynthia will complete her work in business administration by the end of the summer. Dave writes that his better half is putting him under great pressure to go to Europe and stay until the money runs out. . . . **Larry Hall** is completing a three-year tour with U.S. Coast and Geodetic Survey. . . . **Art Warshaw** returned to Harvard Business School to complete his second year after having worked for two years as director of corporate planning at Standard Tool and Die Company in Los Angeles. His wife Chris received her master's in English in June. Art is going to enter the real estate development field in Los Angeles, and Chris may go to law school. . . . **Jesse Mase** is teaching math at Shady Side Academy near Pittsburgh, Pa. . . . **Walter Kuleck** is still employed at Boeing's Vertol Division. They have bought a house, and, although they have no kids, they do have two beagles and three cats. . . . **Larry McNichols** is still employed by Northern Ordnance Division of F.M.C. Corporation, but he has had to cross picket lines for several weeks. Hopefully he has not been forced to join the ranks of the unemployed EE's.—**Jim Swanson,** 1816 First Ave. North, Grand Forks, North Dakota 58201

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As I write this Gail and I are finishing our seventh year at the 'tute—will this last forever? We hope not. If all goes well we may be out of here sometime this fall. However, no more about our plans until we are about to hand in our theses. This month was a banner one for receiving letters from our readers—we got five. Unfortunately there were only three Alumni Fund envelopes so the total number of people we heard from was relatively small. Nevertheless I think it will make for a pretty folksy column.

A Selective Service Story

From **Steve Ostrach** we received the following note, "As you can see from the heading (B Btry 4th Bn 1st Bde, Ft. Bliss, Texas) I am paying my debt to society or at least I think that is the rationale that they gave me, and in any case it is quite difficult to have a meaningful dialogue with the U.S. Marshals and such when they come for you. I got my first notice while I was at CalTech grad school, went home and tried the wholesome high school teacher thing and then went in, grudgingly. I have just about finished my two years as a highly trained mercenary killer and free-

lance defender of the American way of life and now, after devoting this summer to a whole-hearted assault upon the puritan ethic, will start Harvard Law School in the fall. I hope no one objects to my craven capitulation to the Crimson. By the way, is Cambridge still there or has the Charles finally eaten the whole town." Yes, Steve, our fair city is still here, buried under an inch of soot, but still here.

A Prospective Pediatrician

In the May issue we appealed to the spouses of classmates to keep us informed about the careers of their mates. Ruth Swedlow answered our call and we now can report on the doings of Ruth and **Dave Swedlow.** "Dave never would get around to writing this and I like to read about people I know, so. . . . David decided engineering was for the birds (he was in aero), so he decided to go into medicine. It turns out that engineering and the aerospace industry wouldn't have been such a hot idea, and he's really happy with his choice. He's now a third year student at Harvard Medical School and has decided to go into pediatrics. He says children are better than people and airplanes. So tell the people in the Class to save up their children for a while so that they can take them to a Tech man who ended up with a marketable skill—unlike many of our engineering friends." We would like to thank Ruth for her note and encourage other spouses to follow her example. However, the jobs in engineering aren't *that* bleak.

Still in School

From Lincoln, Neb., **Dick Munson** writes that he is finishing a master's degree in math at the University of Nebraska where his wife Betty (Rose) is also finishing a master's degree in political science. Next year he will be studying medicine at the University of South Dakota. Dick reports, "We spend our time singing in a rock band and motorcycling through the vast wheatfields of the midwest." . . . **Ken Marko** informs us that he is "still working" on a Ph.D. in physics despite "lucrative job prospects." Luckily his wife, the former Lynn Whelpy, University of Michigan '69, had enough foresight to forsake anthropology temporarily for library science, with the result "we eat well."

Mel Basan is also "still working" at University Hospital in Boston, and is also attending Suffolk University Law School at night "for recreation." His biggest problem is trying to convince everyone that he is not interested in patent law. . . . **Bob Petkun** has been working for the past two years for Rand Corp. advising government on the management of R. and D. This fall he and his wife, Mary, will return to scenic Cambridge from Southern California while he attends Harvard Business School while Mary "will be teaching and earning the bread."

In May I reported meeting **Ed Seykota** in Boston. Recently we received a note from Ed reporting that he and his wife, Ulanna have moved to Brooklyn. She is working as a radiology nurse while Ed is at C.B.W.L. Hayden, Stone, Inc. as a commodity analyst. He enclosed a recent copy of his firm's "Commodity Commentary" which featured a full-page report by him on the soybean complex. Ed adds, "Commodities are somewhat like stocks and bonds only it takes far less time to lose all your money. Anyone interested in speculating could write me c/o C.B.W.L. Hayden, Stone Inc., 100 Wall St., N.Y. and I'll send them a kit of information." . . . Finally **Tom Murphy** dropped us a note just to say that he enjoyed the column. . . . That's all there is for this month, we hope you're having a nice summer.—**Gail** and **Mike Marcus,** Eastgate Apt. 16A, 60 Wadsworth St., Cambridge, Mass. 02142

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Class news has dropped off to a trickle this month. I imagine everyone is either planning their summer vacations or studying for spring exams. Cambridge weather this spring—cool and wet—has been most conducive to thoughts about sunny California where I will be spending the summer. Moreover, the weather has "coerced" me into putting more time into my studies than I would ordinarily allow for them. It will be interesting to see if my grades go up as a consequence.

This month's class hero award goes to **Denis A. Bovin** who has sent me information on himself and a number of our classmates. Since graduation, Denis has spent a summer in Japan with Mobil Oil and a summer as assistant to the vice chairman of the board of the First National Bank of Chicago. Upon his graduation from Harvard Business School this June, Denis will join the investment banking firm of Salomon Brothers on Wall Street in New York City. In addition to "financing the great names in American Business," he will also be performing some venture capital work. As for members of our class at Harvard Business School (which Denis regards as less challenging than M.I.T.), Denis has provided the following information **"Andy Fillat** and **George Varga** are both in the first year and doing very well. Andy will be spending the summer in Boston doing consulting work and George is doing some fine things in the real estate field. **Tony Lima** and Clyde Rettig, '68, are also alive as I see them every once in a while on campus. **Mike Jordan,** having finished a stint defending our country with the National Guard, is planning to attend Harvard Business School commencing next year." Thanx go to Denis for this information, and I wish him well in the canyons and jungles of Wall Street finance.

I have also received the following notes. . . . **Richard M. Barnes** is now working at the Johns Hopkins Applied Physics Laboratory in radar following his reception of an S.M./S.B. in Course VI in June of 1970. Dick and his wife have a one and a half year-old daughter, Jennifer, and are living in the new planned city of Columbia, Md., where "everyone seems to be an amateur city planner." . . . **David B. Hiatt** is working full time for the Department of Transportation in Cambridge as a computer systems analyst and is going to school full time in the Sloan Masters Program.

Ivan R. Burns, having completed his first year at Harvard Business School, is spending the summer in Zurich, Switzerland where he is working for SwissAir. His fringe benefits include transportation to and from Zurich and ten per cent fares on all flights to cities within Europe. . . . **Franklin P. Rogers** is working in public health in Chicago to fulfill his C.O. obligations after receiving his honorable discharge from the army on C.O. grounds. . . . Drop me a line to let me know what you have been up to this summer—**Richard J. Moen,** 412 Hastings Hall, Cambridge, Mass. 02138

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